POWER **MAY 1960** TRANSMISSION DESIGN OEM MAINTENANCE



HYDROSTATIC ADJU







INCLUDING BEARINGS DESIGN/APPLICATION

ALSO IN THIS ISSUE:

Determining Bearing Loads Due to Power Transmission Planned Obsolescence—Its Effect on Power Transmission System Design DEPENDABLE ROAD MACHINERY

MUST HAVE

DEPENDABLE MECHANICS

. ROLLER BEARING .

UNIVERSAL JOINTS



Your dependable high grade machines deserve MECHANICS Roller Bearing UNIVERSAL JOINTS dependable high quality. And now you can benefit from the protection and convenience of "once-a-season" or "lifetime" lubricated Export Sales:

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roller bearing universal joints so tightly sealed in that dirt and moisture cannot enter. Let our engineers show you how this dependable MECHANICS Roller Bearing UNIVERSAL JOINT will give your machines competitive advantages.

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Borg-Warner . 2038 Harrison Ave., Rockford, III.

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maurey positive drives

give you three mighty advantages

SMOOTH, SLIP-PROOF POWER TRANSMISSION

With belt teeth meshed in pulley grooves, Maurey Positive Drives are slip-proof as chain and gear drives. Maximum power moves to work smoothly, quietly, with uniform speed. There is no rise and fall of pitch line, no slippage, no creeping, no backlash. Here, in brief, is smooth, positive power transmission on heavy loads or the finest precision work.

2 WIDE RANGE OF SPEED AND HORSEPOWER IN COMPACT SIZE

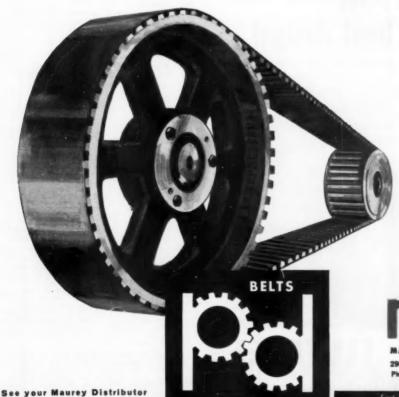
From fractional horsepower to 600 h.p., Maurey Positive Drives are proven drives. Their normal belt speeds range from 100 fpm to 10,000

fpm. Belts and pulleys combine maximum horsepower with minimum space. This inherent compactness is a vital advantage to the designer facing weight and space limitations.

3 LOW COST POWER TRANSMISSION

Since the Maurey Positive Drive does not rely on friction, high initial belt tension is not needed. That means minimum bearing load all the time, and low heat build-up while the drive runs. With no metal-to-metal contact, there is no need of lubricating systems. Adjustable motor bases and idlers are frequently eliminated. With no "extras" and practically no maintenance, here is true economy.







COOPERATION produces the final design!

Cooperation is the key to any product. One man, perhaps you, has the responsibility for adding ideas and correlating the work of others to develop a superior design. Rockford

Clutch has designed and supplied clutches for hundreds of products . . . let them help you. Their recommendations

are without obligation and they are recognized leaders in the field of clutch design and manufacture. Whether it's a clutch for a lift truck, bus, tractor, lathe or other equipmentcall or write for recommendations on the Rockford Clutch to fill

your needs.



ROCKFORD CLUTCH DIVISION



BORG-WARNER

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Brammer Announces

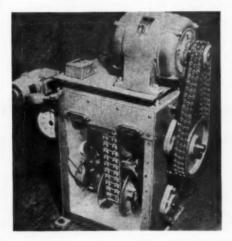
BRAMMER CORPORATION 486 BROADWAY NEW YORK 13, N. Y.

NEW "HYPOWA" . . . THE ONLY DETACHABLE LINK V-BELTING TO USE SYNTHETIC BLENDED FILAMENT YARN

Manufacturers of endless V-belts discontinued the use of cotton yarns when they learned that by utilizing synthetic fibers a V-belt could be made which offered increased horse-power ratings, longer life and less stretch.

BRAMMER KEEPS PACE WITH MODERN INDUSTRY!

To keep up with the progress of endless V-belt manufacturers, BRAMMER is proud to announce . . . HYPOWA . . . a NEW Detachable Vee Link Belting made with SYNTHETIC BLENDED FILAMENT YARNS, IN ALL SIZES, OFFERING HIGHER HORSEPOWER RATINGS, LONGER LIFE, GREATER RESISTANCE TO STRETCH AND LESS VIBRATION . . . AT NO EXTRA COST!



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Now available . . . The New "HYPOWA"

Detachable Vari-Speed Belt by Brammer.

Sizes from 36" to 4" Top Width

It's the Best and Costs Less

Request catalog VS-60

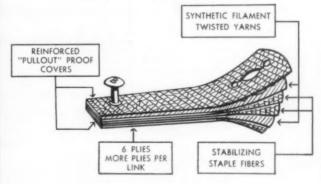
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TRY IT:.. COMPARE IT...

GET MORE FOR YOUR MONEY!

HYPOWA BELTING FURNISHED

FREE FOR TEST PURPOSES!



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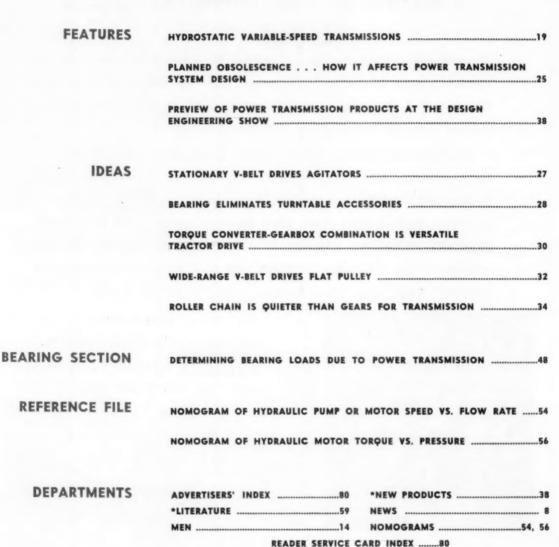
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MAY 1960

volume 2 number 5

POWER TRANSMISSION DESIGN

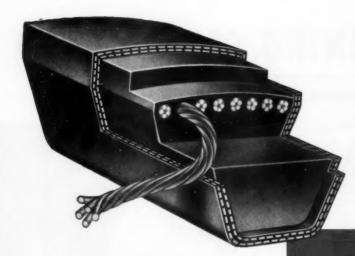






FACTS AT YOUR FINGERTIPS:

Before going further, tear out a Reader Service Card which you will find bound into this issue. Fill it out as you read and mail it when you're done. We'll act on your request immediately.



Need High Capacity In Compact Space?

DA 358 V-BELTS. This major design improvement in V-Belts brings you unprecedented compactness, high capacity and drive economy.

Chain and Gear Benefits with No Metal-to-Metal Contact?

DA POSITIVE DRIVE BELTS. Revolutionary tooth-grip principle; no stretch; no constant lubrication. Highly versatile.

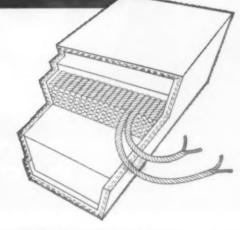
Whatever your V-Belt needs, DURKEE-ATWOOD meets them

What do you want in a V-Belt? You want consistent performance, long trouble-free life and full-rated power transmission. That means the belts must be made of the finest quality materials, with careful attention to engineering details, manufacturing processes and testing procedures. Durkee-Atwood V-Belts are made of the newest high tenacity synthetic fibres to assure length stability in storage. The exclusive Durkee-Atwood "Iso-Dynamic" Vertical Matching Machine eliminates the "sag error" that develops when V-Belts are matched on horizontal equipment. This assures equal power transmission from all belts on multiple drives . . . Look to Durkee-Atwood for quality, service and savings ... the most complete line of industrial V-Belts.

Look for the



On Your V - Belts



40% Extra Capacity in Regular V-Belts?

RED SHIELD MULTIPLE V-BELTS. Increased capacity at no increased cost. Available in oil and heat resistant and static dissipating constructions.



Top Performance in Variable Speed Drives?

VARIABLE SPEED BELTS. For constant performance. Abrasion-resistant cover; crowned cross section maintains stability under extreme loads.

DURKEE-ATWOOD V-BELTS

DURKEE-ATWOOD COMPANY

MINNEAPOLIS 13, MINNESOTA

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The OVER-RUNNING CLUTCH With

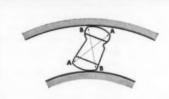


STANDARD CLUTCHES FOR ORIGINAL EQUIPMENT NEEDS



Formsprag Clutches are used throughout industry, from business machines to aircraft, in bore sizes from ¼" to 12". Several informative bulletins available, including: "Design Considerations for High-Speed Over-running Clutches," "Ten Design Ideas", "Seven Ways to Reduce Space and Costs", plus the complete Formsprag catalog. Write for any one or all.

HERE'S



The Formsprag clutch consists of a full complement of shaped sprags, or wedges, located between concentric inner and outer races. Power is transmitted from one race to the other by the wedging action of the sprags. Each sprag is so shaped that dimension AA is greater than BB. Rotation of one race in the "driving" direction causes the sprags to wedge, transmitting torque in full from one race to the other.

Greatest Torque Per Inch - Per Ounce

Modern power transmission design demands the utmost torque capacity in an absolute minimum of space. That's why designers in every field specify Formsprag clutches . . . the modern way to transmit power on over-running, back-stopping

and indexing applications.

Along with highest possible torque capacity for its size and weight, every Formsprag clutch offers such additional benefits as internal simplicity (just four basic parts), no measurable backlash. light weight, compactness, extreme precision and long, trouble-free life. Formsprag's exclusive, patented principle is unlimited in application, yet this fullcomplement sprag type clutch is extremely simple in design and operation.

There is a size and model Formsprag

clutch for every application. Standard models include sleeve bearing, ball bearing, miniature, and large bore backstop types. These are shown in the current Formsprag catalog, complete with specifications, performance data and design suggestions. Ask your Formsprag distributor, or write direct for your copy. For special applications, Formsprag engineers will recommend a modified standard or design a special. Send details of your requirements.

FORMSPRAG COMPANY 23587 Hoover Road, Dept. 104 Warren (Detroit), Michigan

In Canada: Renold Chains Canada, Limited In United Kingdom: Renold Chains, Limited Distributors in Principal Cities

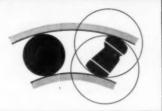


RMSPRAG CLUTCHES

Precision Power Transmission Products

WORKS





An expanding coil spring keeps the sprags in light contact with both inner and outer races. There is thus no lost motion, the driving torque being in-stantaneously transmitted between races. The Formsprag Clutch is so designed that it will transmit a greater torque in relation to its size and weight, than any other comparable type of clutch...specify Formsprag on over-running, back-stopping and indexing applications.

Forcing a ball or roller into a curved. wedged space is an old over-running clutch principle. The sprag is, in effect, "roller" of increased diameter with greater contact surface in a given annular space. Formsprag Clutches engage at constantly changing contact points. Clutch life is prolonged and backlash eliminated. Also, with the inclined surfaces discarded, more sprags can be inserted to increase torque capacity.

Circle No. 21 on Reader Service Card

OTHER FORMSPRAG PRECISION PRODUCTS

RAWSON Centrifugal Clutches

No-Load Motor Starts. Cushioned Starting of High-Inertia Loads, Overload Protection.



REVILOR

Dual Torque-Locking and Positioning Device Eliminates Feed-back Torque, Provides Two-Di-

rectional Drive, Positioning, Overrunning and Backstopping.

Specify

SPECON for

VARIABLE SPEED

electrical and mechanical



- from 1/2 to 75 hp.
- · output speed ranges: 0-100 to 0-7000 rpm
- · smoothly adjustable through zero speed
- · draw accuracies of .01%
- · full torque at zero speed

These are just some of the outstanding characteristics of Specon variable speed drives. Rugged, reliable and requiring minimum maintenance, they permit infinitely fine adjustment of output speed with accuracies approaching fixed gearing. Specon drives also feature shockless starts and acceleration, full reversing, and provide output speeds up to 7000 rpm while maintaining zero speed features. Send for FREE data booklet on Specon variable speed drives

TRATO:

INDUSTRIAL PRODUCTS BRANCH #42, Route 189, West Babylon, N. Y

Circle No. 40 on Reader Service Card

NEWS from the power transmission field



Vintage car gets power from sunlight

CHICAGO, ILL.—An automobile powered by sunshine was exhibited recently during the American Power Conference. The car, a 1912 Baker electric, was adapted to use solar energy by International Rectifier Corp., El Segundo, Calif.

The car has 10,000 silicon solar cells mounted on its roof in a detachable 26-sq-ft panel. Sunlight energizes electrons in the cells, which charge the car's 72-volt battery system. The car then works off the batteries.

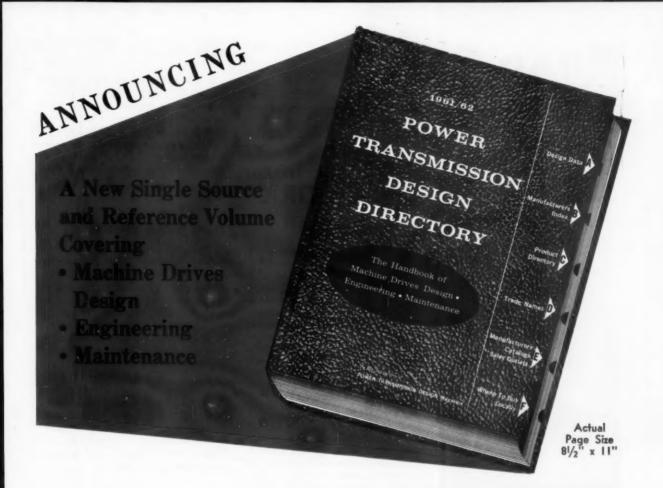
Form non-restrictive fluid power society

MILWAUKEE, WIS .- A society has been formed for anyone interested in any phase of fluid power. Called the Fluid Power Society, it was suggested by the National Fluid Power Association and the Industrial Hvdraulics Training Association.

Membership will be open to indi-

viduals, regardless of company affiliation or technical training. Principal activities will be handled by local chapters, and each may have its own local field of interest. Or, chapters may have several sections specializing in different fields.

First meeting of the new society



Here is an opportunity to put your product specifications right on the desks, drawing boards and reference shelves of the OEM and in-plant men who use them . . . and keep them there for 24 months.

PRODUCTS TO BE INCLUDED: • bearings • prime movers • shafts and couplings • belt drives • chain drives • variable speed drives • gears and gear drives • brakes and clutches • lubricating systems

Schedule your advertising insert or catalog or supply advertising plates for printed pages. It's an investment that will bring you sales dividends for 24 months.

GLOSING BANK WITH 15 1140

Power Transmission Design Directory

812 Huron Road • Cleveland 15, Ohio • SUperior 1-9626 SALES OFFICES: New York • Chicago • Les Angeles • London Directory will be distributed to key designers and plant engineers

These special features will give them fingertip quick design reference and source information:

Power Transmission
Design Components Directory

Manufacturers Catalogs and Sales Outlets

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Design Reference Data

Trade Name Listings

Where to Buy Locally

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Applications and Developments

All in a single hard bound reference volume

BRAD FOOTE

gedirs

...FOR A WORLD AT WORK

BRAD FOOTE'S DEEP CASE HARDENING

process has been perfected to a degree which practically eliminates distortion



GEARS RUN TRUE

No place is distortion control more important than on heavy duty gears which are run almost continuously at full rating and subjected to extreme shock loads such as are encountered in rolling mill operations.

BRAD FOOTE DEEP CASE HARDENED gears run true and distribute the load evenly across the full face and on the designed bearing surfaces of each tooth.

HARD TOOTH SURFACES

In addition, BRAD FOOTE rigidly controls to set standards the depth of **DEEP CASE**HARDENING and the carbon content. The tooth surfaces are wear-resistant and of maximum hardness for long life, but the carbon content is gradually diminished at successive depths below the surface until it blends to the metal of the core itself.

SHOCK-RESISTANT CORES

Thus the cores of the teeth and the body of the gear remain ductile and shock-resistant while the teeth are given an increase in service life of over 50%.

ORDER FROM BRAD FOOTE

Your order for BRAD FOOTE Gears will be processed by an experienced organization of gear specialists and produced on the most extensive and versatile facilities available. Maximum performance and your complete satisfaction are assured.

BRAD FOOTE MAKES

Spur Bevel Helical Spiral Bevel Herringbone Warms
Worm Gears
Racks
Internal Gears
Reducers
Transmissions

Send for new Bulletin #101
Find out what BRAD FOOTE's
two generations of gear building
experience can do for YOU.
Write today



BRAD FOOTE GEAR WORKS, INC.

1313 South Cicero Avenue • Cicero 50, Illinois • Blshop 2-1070 • OLympic 2-7700 subsidiary • PITTSBURGH GEAR COMPANY, Neville Island • Pittsburgh 25, Pa., Phones SPaulding 1-4600

Circle No. 5 on Reader Service Card

NEWS continued

was held last month in Detroit, where members of the Industrial Hydraulics Training Association were chartered as Chapter No. 1. Chapter No. 2 is being formed in Milwaukee.

For more details, contact Barrett Rogers, executive vice president, National Fluid Power Association, 5595 N. Hollywood Ave., Milwaukee 17, Wis.

New NEMA division

NEW YORK, N. Y.—The National Electrical Manufacturers Association has formed an Industrial Equipment Div. as part of a plan to reorganize the association.

E. E. Helm, president, The Reliance Electric & Engineering Co., has been elected chairman of the new division, which is made up of these NEMA sections: Industrial Control, Motor and Generator, Renewal Parts, Carbon, Manufactured Graphite, Arc Welding, Electrical Contacts, Industrial Automatic Systems, Automatic Temperature Controls, Adsorption, Industrial Heating Units and Devices, Mining Belt Conveyor, and Mining and Industrial Locomotive.

Ramsey moves plant

ALBANY, N. Y.—Ramsey Products Corp. has moved its manufacturing facilities for silent chain, sprockets, and couplings to a new plant in Charlotte, N. C., located in the Piedmont Industrial Crescent.

The move is expected to strengthen the firm's position in the industry. Plans are to improve manufacturing techniques and methods on chain and related products, initiate a research and development program to improve present products, study new applications for these products and to develop new products in the power transmission field.

Detroit Transmission receives gear award

DETROIT, MICH.—The Detroit Transmission Div., General Motors Corp., has been awarded an honor citation for "excellence in gear production and for effective use of modern gear production equipment." The award was presented to F. J. McDonald, works manager, and R. R. Jensen,

HERE'S WHAT ANOTHER FAWICK USER SAYS:

Walt M. Eklund, Maintenance Superintendent, and bricks produced on Fawick-equipped International Brick Press, the first of which was converted to Fawick Clutches in 1954.

Production increased 25%!

Safety at maximum! 99

That's the word from Walt M. Eklund, Maintenance Superintendent at the Kaiser Refractories & Chemicals Division's Basic Refractories Plant, Moss Landing, California. Kaiser Refractories used FAWICK Airflex Clutches to replace mechanical units which were not adapted to the continual starting and stopping necessary for pressing brick. Simplified drum-type design and automatic adjustment of the FAWICK units have minimized maintenance expense and substantially increased production.

In this brick pressing operation, the operator must see that the mix of chrome and periclase discharges into the mold, operate the press to compress and shape the brick, then remove it by hand. Actuation of the press through the FAWICK Clutch is by push-button control, adding greatly to production speed. Simultaneous release of the clutch and application of the brake are accomplished through controls actuated by interrupting a beam from three photo-electric cells mounted on the front of the press. This feature provides maximum safety against re-cycling of the press in case the operator tries to remove the shape too soon or too late.

This application of advanced power-transmission techniques shows how FAWICK can help you gain production profits by increasing machine operator efficiency and improving safety. Get full information from your nearest FAWICK Representative, or contact the Home Office, Cleveland, Ohio.



INDUSTRIAL. CLUTCHES AND BRAKES

See our booths 1136 and 1138 at the Design Engineering Show



AIRFLEX DIVISION

9919 CLINTON ROAD . CLEVELAND II, OHIO da, Ltd., 60 Front St., West, Toronto, Ont., Canada



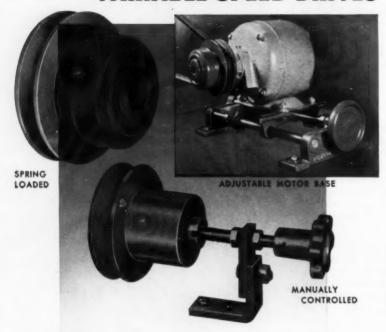
FAWICK 20CB500 type CB Airflex Clutch (under flywheel rim) and FAWICK 21.5-E4.75 type E Air-Ring Brake provide Internaoperation and freedom from maintenance under heavy duty service.



Accurate stopping during custom brick production is an important safety factor in brick making, press by hand. Interrupting beam from photomultaneously disengages dental re-cycling

Browning

VARIABLE SPEED DRIVES



Now you can get famed Browning quality in motion controlled variable speed drives. Serving ½ to 2 hp requirements, this new Browning line includes:

- ▶ Spring loaded variable pitch sheaves; 3", 4", 5" and 6" OD
- Manually controlled variable pitch sheaves in same sizes
- Adjustable motor base, for quick accurate adjustment of center distance

Browning's spring loaded sheave replaces any ordinary sheave, driver or driven, to provide a wide speed range simply by adjusting center distance. In combination with the new manually controlled type, twice the normal range is attained with no change in center distance and without misalignment. The convenient bracket knob permits infinite speed control. Both sheaves use oil impregnated bushings that are lubrication-free, always clean, always low in maintenance.

Browning variable speed drives help you achieve maximum production from your equipment. Your Browning distributor can give you complete details. Ask for Catalog SL-101. Browning Manufacturing Company, Maysville, Kentucky.



Circle No. 54 on Render Service Card

NEWS continued

master mechanic of the plant, by M. R. Anderson, president of Michigan Tool Co., sponsors of the annual awards.

Selection of companies to be honored requires the unanimous vote of a committee of engineers headed by the research director of Michigan Tool.

Wood's names Palmer

CHAMBERSBURG, PA.—T. B. Wood's Sons Co. has appointed Palmer Bearing Co., Cleveland, Ohio, distributor for sheaves, flexible couplings, toothed belt drives, and iron goods. Palmer has branches in Sandusky and Warren, Ohio, and East McKeesport, Pa.

MEETINGS

MAY

23-26 American Society of Mechanical Engineers, 1960 Design Engineering Conference, Coliseum, New York, N. Y.

JUNE

- 5-10 Society of Automotive Engineers, Summer Meeting, Edgewater Beach Hotel, Chicago, Ill.
- 6-8 American Gear Manufacturers Association, 44th Annual Meeting, The Homestead, Hot Springs, Va.

SEPTEMBER

- 14-16 National Petroleum Association, Annual Meeting, Hotel Traymore, Atlantic City, N. J.
- 15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, Engineering Management Conference, Joint Committee, Morrison Hotel, Chicago, Ill.

OCTOBER

17-19 American Society of Mechanical Engineers-American Society of Lubrication Engineers, Lubrication Conference, Statler Hilton Hotel, Boston, Mass.

30-

Nov. 1 National Lubricating Grease Institute, Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

NOVEMBER

27-

Dec. 2 American Society of Mechanical Engineers, Annual Meeting, Statler Hilton Hotel, New York, N. Y. From WARNER AUTOMOTIVE ...

A STRONGER, yet LIGHTER HAY BALER GEAR BOX BUILT BY





Developed by Warner Automotive to Help CASE Engineers Solve a Problem...

The problem: To design a simplified, foolproof, surge-free power train for the CASE Model 200 SweepFeed Hay Baler at a cost that would justify its purchase by farm operators.

World-famous CASE engineers searched for months for a suitable gear box . . . rugged, dependable, yet lightweight. They brought their problem to Warner Automotive engineers, specialists in mechanical power transmission. Warner produced a large, high capacity gear box that successfully withstood the most exhaustive tests CASE engineers could devise for it. All CASE 200 Hay Balers are now equipped with this B-W Gear Box.

CONSULT OUR ENGINEERS FOR TRANSMISSION GEARS, GEAR ASSEM-BLIES, RING GEARS AND PINIONS, DIFFERENTIAL PARTS AND ASSEM-BLIES, POWER TAKE-OFFS, SPLINED SHAFTS



- Housing of a malleable iron—lightweight, but stronger and more rigid.
- Hypoid gears, carburized for long life.
- Integral ring gear carrier and splined crankshaft.
- · Tapered root spline on input shaft.
- Anti-friction bearings throughout.

See us at the Design Engineering Show—Booth No. 2213

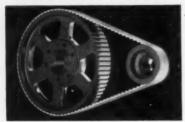


WARNER AUTOMOTIVE DIVISION

BORG-WARNER CORPORATION

Auburn, Indiana

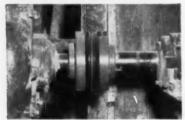
WOOD'S POWER TRANSMISSION PRODUCT NEWS



POSITIVE ACTION-LONG LIFE

Wood's Timing Belt Drives provide positive, slipfree action. Belts are all muscle. No high initial tension, tension devices or lubrication needed. Drives are light weight, compact... quiet and clean. Wide load and speed range. Equipped with famous Sure-Grip Bushings. Write for Bulletin 2100.

Circle No. 49 on Reader Service Card



4-WAY FLEX-UNIQUE DESIGN

Wood's Sure-Flex Couplings absorb 5 to 15 times more shock and vibration than other leading flexible couplings...swallow all types and combinations of angular and parallel misalignment, endfloat. Simple, no wear, no lubrication. Low cost. Write for Bulletin 5103.

Circle No. 50 on Reader Service Card



REVOLUTIONARY NEW VARIABLE

Revolutionary resilient cam follower construction of Wood's new "MCS" motion control, variable speed drives holds constant driven speeds under varying torque loads. Like the "MS," the "MCS" won't freeze or stick. Check oil only once or twice a year. Write for Bulletins 8102, 4101.

Circle No. 51 on Reader Service Card

MP/360A

T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PENNSYLVANIA
ATLANTA • CAMBRIDGE • CHICAGO
CLEVELAND • DALLAS

MEN of the power transmission field

Thompson joins Manheim

MANHEIM, PA.—Lawrence M. Thompson, formerly with Firestone Tire & Rubber Co., has joined Man-



THOMPSON

heim Mfg. & Belting Co. as director of engineering. He'll be responsible for quality control, product research and development, and plant engineering.

Hewitt Rubber

STAMFORD, CONN.—E. J. Mytkowicz has been appointed to the new position of vice president in charge of operations of the Hewitt Rubber Div., Hewitt-Robins, Inc. With the company since 1947, Mytkowicz formerly was manager of operations of the Jones Machinery Div.

Salsbury elects Tuthill to board

Los Angeles, Calif.—James W. Tuthill has been elected to the board of directors and the executive



TUTHILL

committee of Salsbury Corp. Tuthill has filled various executive positions for the past 19 years, most recently as senior vice president, Royal Industries, Inc.

Leo Sullivan dies; was Russell Mfg. vp

MIDDLETOWN, CONN.—Leo S. Sullivan, vice president in charge of sales at Russell Mfg. Co., died in New York while attending the Interna-



SULLIVAN

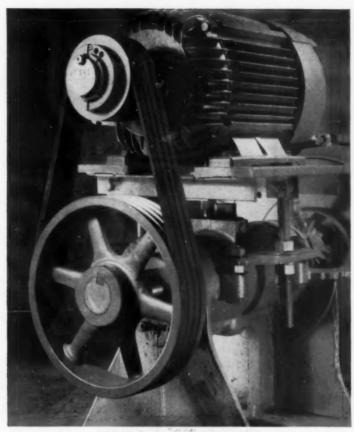
tional Automotive Service Industries Show at the Coliseum. Mr. Sullivan was well known in the automotive industry, and had been with Russell for 37 years.

Dayton Rubber names Rosenberg

DAYTON, OHIO—Richard D. Rosenberg, formerly manager of Dayton Rubber Co.'s Dayton Rubber International division, has been appointed vice president in charge of international operations.

Chain Belt appoints

MILWAUKEE, WIS.—Chain Belt Co. has made these appointments: Lyman E. Newton, former controller, becomes executive vice president and director of Chain Belt (Canada) Ltd., Toronto subsidiary; Henry L. Fjellman, former divisional controller, succeeds Newton as controller; Bernard G. Schneider former chief engineer of the conveyor and process equipment division, is now conveyor equipment sales man-



Patented construction eliminates fretting corrosion, freezing and the need for lubrication.

New Wood's "SVS" Variable Speed Sheave won't freeze... needs no lubrication!

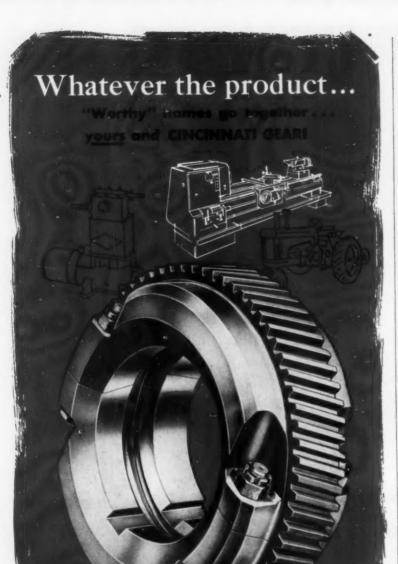
Wood's new "SVS" variable speed sheave won't freeze . . . needs no lubrication. Positive locking collars, which cannot be over-tightened, securely clamp split flange extensions into place, eliminating fretting corrosion. Patented design features assure quick, easy speed adjustment. You simply loosen the two locking collars and turn the adjusting screw from either side.

Wood's "SVS" is a stationary control, multiple groove sheave which uses standard v-belts and stock driven sheaves. It is of simple, highly efficient design and sturdy construction, accurately balanced to assure smooth operation and long drive life. Installation is easily made on stub or through shafts. Drive capacities range from 10 to 150 horsepower. Get the complete story.



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MEN continued

ager; Frank G. Stuller, former manager of application engineering succeeds Schneider; J. Walter Snavely. former marketing manager of conveyor equipment, is promoted to assistant district sales manager, Milwaukee district.

Orange elects officers

ORANGE, N. J.—Orange Roller Bearing Co., Inc., elected these new officers: August Lundelius, vice president and general manager, Metalsmiths Div.; Adelmo Botta, vice president and general manager, Bearing Div.; Thomas E. Cushing, assistant secretary; Edwin F. Kopp, assistant treasurer. These officers continue to serve: James A. Burden, chairman of the board; C. L. Ritchie, president and treasurer; Aloysius Schaeffner, secretary. Robert W. Farmer was appointed chief engineer.

DIPCO names two district managers

MELROSE PARK, ILL.—Dayton Industrial Products Co. has appointed two district sales managers: Dale F.



ROMOHR



DOOLEY

Romohr will handle industrial accounts in the Cincinnati sales region, including West Virginia, parts of Kentucky and Ohio; John E. Dooley will handle automotive distributor accounts in New York and Vermont.

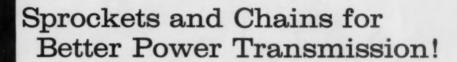
American Pulley names central sales manager

PHILADELPHIA, PA.—Malcolm F. Bell has joined The American Pulley Co. as central sales manager, responsible for sales of both the power transmission and materials handling divisions. The central territory includes districts surrounding Pittsburgh, Detroit, Chicago, Minneapolis, and St. Louis. Bell formerly was an account specialist for Gooding Rubber Co.

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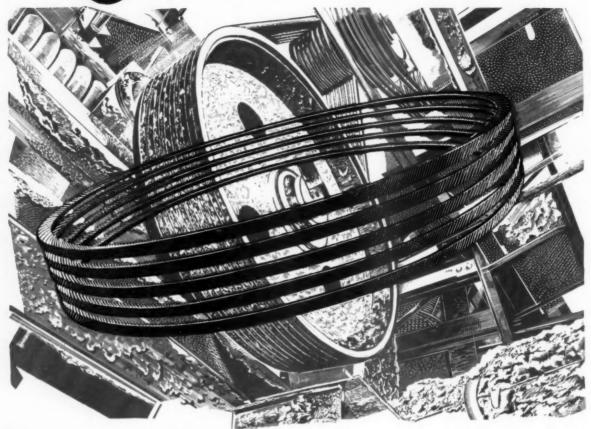
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"Swinging Loads" demonstrate how

balanced driving power pays off

The flywheels on stone-crushing machinery at the Bethayres Concrete Products Company in Bethayres, Pa., put V-belts under a "tremendous strain."

Not only must each set of 8 U.S. Royal V-Belts driving the flywheel operate under extremes of abrasive conditions, it must also operate on constantly changing centers. As incompressible foreign matter enters the driven rollers, they swing or oscillate to allow passage. The result is constantly changing tensions under pressures amounting to many tons!

Yet even with this constant change in tensions and the severity of the abrasive conditions, the U. S. Royal V-Belts continue to share the load for an average of one year of rock-breaking service.

The C-210's used on these V-sheave to flat-surface drives,

like all of the approximately 250 "U. S." belts in 48 different sizes used throughout the Bethayres plant, have a built-in advantage. "Balanced driving power"... the result of specially developed manufacturing equipment that automatically controls weight, dimensions, density, length, and tension members... helps provide a uniformity, toughness, length stability and true-running smoothness that have paid off in job after job, plant after plant the nation over.

Put balanced driving power to work in your own operations. See your "U. S." Power Transmission Distributor for full stocks and expert service.

U. S. Royal V-Belts and engineering assistance for these drives supplied by "U. S." Distributor Lindsay-Oberholzer of Philadelphia, Pa.

"Visit Booth 1324, Design Engineering Show, New York Coliseum, May 23-26."



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Hydrostatic variable-speed transmissions

Types

Sizes

Characteristics

A HYDRAULIC variable-speed transmission uses a fluid, usually oil, as a power transmitting medium between the input and output shafts. There are two broad labels which embrace all types—hydrostatic and hydrodynamic. Hydrostatic variable-speed transmissions depend upon the pressure energy of the fluid for power transmission. Hydrodynamic types convert the kinetic energy of fluid in motion into output torque and rotation. Except for the use of a fluid as a power transmitting medium, there is little similarity between the two types. This article is about hydrostatic transmissions. A future article will cover hydrodynamic types.

A positive displacement pump and hydraulic motor, Fig. 1, are the essential elements of a hydrostatic transmission. Positive displacement means that there is virtually no change in the delivery rate of the pump as pressure at the output port changes, or in the speed of the motor as load torque requirement fluctuates. This is shown by the following equations.

$$Q = \frac{nD}{231}$$
(1)

$$T = \frac{Dp}{24\pi} \qquad (2)$$

where Q = fluid flow, gpm

n = rpm

D = pump or motor displacement, cu in/rev

T = torque, lb-ft

p = pressure, psi

Equation 1 shows that for a given pump or motor, speed and flow rate are directly proportional, since

*Nomograms to solve these equations are included in this issue in the Reference File, pages 54 and 56.

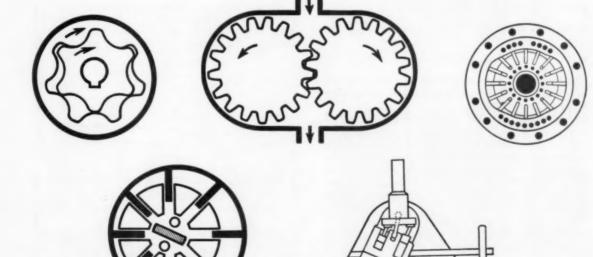


Fig. 1. Positive-displacement hydraulic pumps and motors vary in design. They all have the characteristics

shown in Figure 2. These sketches are simplified sections through pump or motor operating elements.

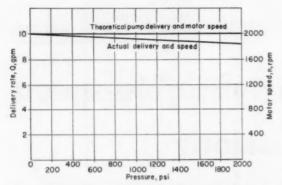


Fig. 2. Theoretical and actual performance characteristics of positive displacement pumps and motors. Slip, leakage through the running clearances, makes the difference.



the only other variable in the equation is D which is fixed by the physical dimensions of the pump or motor. Equation 2 shows that torque of a hydraulic motor of given displacement depends only upon the pressure supplied. Actual characteristics of positive-displacement pumps and motors are slightly modified by slip or internal leakage of fluids through the running clearances. Because the slip increases as pressure increases, pump and motor delivery and speed decrease slightly as pressure increases, see Figure 2.

Efficiency

Slip is a loss, and it reduces the efficiency of hydrostatic transmissions. Volumetric efficiency—the ratio of actual to theoretical delivery—is the measure of the amount of this loss.

Equation 3 is for pumps; Equation 4 for motors. Overall volumetric efficiency of a hydrostatic transmission is the product of the two.

Typical values of volumetric efficiency for actual pumps and motors range from 60 to nearly 99%. Figure 3 shows volumetric efficiency of an actual pump.

How well the unit is made, and its design are the factors which determine volumetric efficiency. For these reasons, it's also true that the higher the volumetric efficiency, the higher the price, all other things being equal.

Since slip is nearly independent of speed, volumetric efficiency of hydrostatic transmissions decreases as output speed decreases, if pressure is constant, Fig. 4. This is because losses are constant while power transmitted decreases as output speed decreases. Therefore, when a job calls for low output speeds, a speed reducer should usually be used to keep transmission output speed and efficiency reasonably high.

Friction from bearings and rubbing surfaces, as in

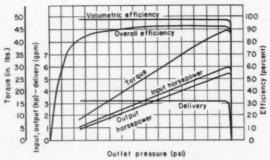


Fig. 3. Performance curves for a pump include volumetric efficiency and overall efficiency. Overall efficiency is the product of volumetric and mechanical efficiencies.

all mechanical devices, also subtracts some of the input power to lower efficiency. This loss determines the mechanical efficiency. Mechanical efficiencies of pumps and motors may be above 95%.

Overall efficiency of a hydrostatic transmission is the product of the overall efficiencies of pump and motor. Overall efficiencies of these units are the product of the volumetric and mechanical efficiencies. Despite this compounding, overall efficiencies of these transmissions may still exceed 90%.

Unit and split transmissions

When the pump, motor, and necessary control elements of a hydrostatic transmission are built into a single housing, the assembly is labelled a *unit* transmission, Fig. 5. When the same components are installed separately at different locations, the system is called a *split* transmission, Fig. 6. Each of these has certain advantages.

Primary advantage of the split transmission in addition to those inherent with all hydrostatic transmissions, is that power may be transmitted over long distances, around corners, into confined spaces, and to

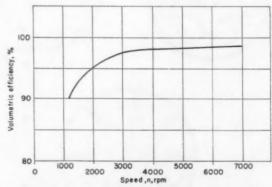


Fig. 4. Volumetric efficiency and speed curve shows that volumetric efficiency decreases at low rpm. This curve is for a small, high-speed unit, Noticeable decrease in volumetric efficiency for a unit with maximum operating speed of 2000 rpm would probably not occur above 500 rpm.

moving members through hoses, swiveling, and telescoping connections.

Unit transmissions offer: small size, neat installation, and single source responsibility for performance. Also, they eliminate or greatly reduce the probability of leakage which is probably the biggest single problem in hydrostatic systems.

Speed, torque, horsepower

Speed variation in hydrostatic transmissions is usually obtained in two ways. One is by mechanically varying the displacement of the pump; the other by varying displacement of the motor. Each of these produces a particular type of torque-horsepower characteristic.

When pump displacement is varied, available torque output is constant and horsepower increases with speed, Fig. 7. By varying motor displacement, the available torque output is maximum at zero speed and decreases as speed increases; horsepower is nearly constant over the speed range, Fig. 8. The two may also be combined in a single transmission to give torque-horsepower characteristics that combine the features of both, Fig. 9.

In addition to the effect upon torque-horsepower characteristics, there are important differences in the ranges of speeds available when a variable-displacement pump or motor is used. When pump displacement is variable, speed is variable from zero to maximum, and the pump may be reversible to give reversed motor rotation with speeds up to the same maximum as in the forward direction.

If only the fluid motor is the variable-displacement unit, speed range is limited to about 4:1. Motor rotation cannot be reversed by varying motor displacement.

Horsepower outputs of hydrostatic transmissions range from fractional to 4000 hp. Torques as high as 500,000 in-lb are available. Top output speeds of over 5000 rpm may be had in small sizes. However, the majority of units have top speeds between 1000 and 3000 rpm. The 4000-hp unit mentioned has top speed of 400 rpm.

Advantages

In addition to the previously mentioned advantages of split and unit transmissions, response speed is probably the most outstanding advantage of these units. They will accelerate, decelerate and reverse faster than any other type of power transmission system, in the integral horsepower range. This is because

Fig. 5. Some typical unit transmissions. Small unit, a, is rated $\frac{3}{4}$ hp.; measures approximately $10 \cdot \frac{1}{4} \times 7 \cdot \frac{3}{6}$ by 7-1/16 in. It delivers 40 lb-in. torque at speeds from zero to 1750 rpm in either direction of rotation. The $44 \times 24 \times 21$ -in. unit, b, is rated 25 hp, and delivers a maximum of 1760 lb-in. of torque at speeds from zero to 1090 rpm. Cutaway transmission, c, is one of a line rated from about 1.5 to 22 hp. Photo a, courtesy Vickers Inc.; photo b, courtesy Oilgear Co.; photo c, courtesy Crofts, U. S. A. Inc.

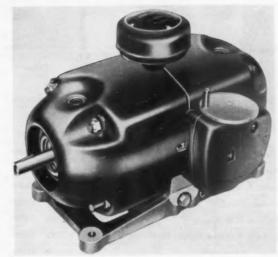


FIGURE 5a

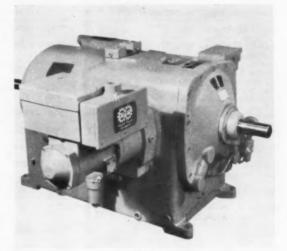


FIGURE 5b

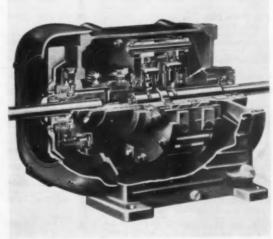


FIGURE 5e

Table I -- Hydraulic Pump

Manufacturer	VD	Speed range (rpm)	Pressure range (psi)	Displace- ment (in.3/rev)	VD	HP	aracteristics—— Speed range (rpm)
	-	-700 - 0000					
Adel Precision Products Div. General Metals Corp.	N	<500->3600	< 500->2000	<.2->7	_	_	_
American Bosch Div. American Bosch Arma Corp.	N	-	5000		N	< 5->20	<150->2000
American Brake Shoe Co., Kellog Div.	Y	<500- $>$ 1800	>5000	< 1.>2	Y	_	< 50->2000
American Engineering Co.	Y	<500- 1200	<1000- 5000	< 2->15	N	< 5->20	< 50- 1000
John S. Barnes Corp.	N	<150->2000	<1000	.5- 10	N	_	<150->2000
Be-Ge Mfg. Co.	N	<200- 3000	2000	1->10	_	_	_
Behlen Mfg. Co.	N	<200- 1800	1500	4- 7	_	_	_
Bendix Aviation Corp., Hamilton Div.	Y	<200->1800	5000	< 1. 2	_	_	-
Berry Hydraulies	N	<200- 3000	<1500- 3000	<.2- 10	N	5->80	< 50->2000
Bicontinental Engineering	N	<200->1800	1000- 3000	< 1.>4	N	< 5->20	< 50- 2000
Blackhawk Mfg. Co., Industrial Div.	N	->1800	< 5000-	< 1		_	_
Brand Hydraulies Inc.	N	<200- 1800	3000	1- 2	_	_	_
Browne & Sharpe Mfg. Co. Hydraulies Div.	Y	<200->3600	>2000	<.2->15	N	< 5->60	< 50->2000
Cessna Aircraft Co. Industrial Products Div.	N	<200- 3000	>2000	.2->4	-	_	_
Commercial Shearing & Stamping Co.	N	<500- 1800	2000	1->10	N	1.>10	<400- 1500
Cornelius Co.	N	<200->1800	3000- 5000	< 1->4	N	< 5->80	< 50->2000
Davies Bros.	Y	<200- 1800	1000	< 1->2		_	-
De Laval Steam Turbine Co.	N	<500->3600	< 500->2000	1->10	_	_	_
Denison Engineering Div. American Brake Shoe Co.	Y	<200->1800	5000	<.5->15	Y	>80	<150->2000
Donnell Hydraulie Co.	N	<200->1800	<1000->5000	< 1->4	_	_	_
Double A Products Co. Div. Brown & Sharpe Mfg. Co.	_		-	_	N	< 1.>10	<150->2000
Dynex Inc.	Y	<200- $>$ 1800	3000	< 1- 4	N	< 5->20	< 50->2000
Eastern Industries Inc.	N	<200- 1800	>2000	<.2- 4	N	< 1.>3	<150->2000
Eaton Mfg. Co., Pump Div.	N	<500- $>$ 3600	2000	.2- 4	_		
Fluid Power Equipment Co. Inc.	Y	<500- 1800	1000	1->7	N	< 5->10	<150- 2000
Fox River Mfg. Co. Div. Hein-Werner Corp.	N	<500- 1800	1000	_	N	>10	<400- 1500
Fulflo Specialties Co. Inc.	N	1200	500	2- 4	_	_	_
General Hydraulies Inc.	N	<500- 3000	2000	1->7	N	5->20	<150->2000
Greenlee Tool Co.	N	->1800	>5000	< 1. 2	_	_	_
Gresen Mfg. Co.	N	<200- 1800	>1000	.5->4	_	_	_
Groban Supply Co.	N	<500- 1500	1500	1. 2	_	_	_
Hamilton-Standard Div. United Aircraft Co.	Y	<500->1800	3000- 5000	<1.>4	-	-	_
Hein-Werner Corp.	N	- 1800	>5000	< 1	_	_	_
Hydra-Flex Inc.	N	<200- 1800	- 1500	2->10	N	1->10	<400- 2000
Hydraulic-Electronic Div., Fawiek Corp.	N	<200- 3600	- 2000	<.2->7	N	< 5->30	< 50- 1500
Hydraulic Press Mfg. Co. Div. Koehring Co.	Y	- 1800	1500- 3000	.2->15	Y	>10->80	<400- 2000
Hydraulic Products Div. Clark Equipment Co.	N	>3600	>2000	1.>10	N	1->10	>2000
Hydraulic Unit Specialties Co.	N	<500- 1800	- 1000	.2- 1	_	_	_

and Motor Characteristics

	VD		ed ge	Pres rai (p	sure	Displa men (in.3/r	t	VD	—Motor HP		Speed range (rpm)
Hydreco Div. New York Air Brake Co.	N	<200-	3000	2000		< 1.>	>15	N	< 1.>6	0	< 50->200
Kraissl Co. Inc.	N		1800	500		< 1.	>10	_	_		_
Lear Inc., Romee Div.	N	<200->	3600	500-	3000	<.2-	>2	N	< 1->5		< 50->200
M. C. Mfg. Co.	N	<200-	3000	1	_	.5		_	_		_
Mechanisms Co.	N	< 500-	3600		>1000	1.	2	_	_		_
Monarch Road Machinery Co.	N		3000	1500		<.2-	1	_	_		_
National Water Lift Co.	N	<500->	3600	1000		<.2	1	Y	< 1- 2	0	< 50->200
New York Air Brake Co., Watertown Div.	Y	<200->	1800	5000		< 1-	4	Y	< 5->8	0	<150->200
W. H. Nichols Co.	N		3600	1000		7-	10	_	_		_
Northern Ordnance Inc.	Y	<200-	1800	500-	5000	< 1->	>15	4	_		_
Oberdorfer Foundries Inc.	N	< 500-	1800	500-	1000	<.2-	4	_	_		_
Oilgear Co.	Y	<500->	1800	1000-	5000	< 1-	>15	Y	< 5->8	0	< 50->200
Oil-Dyne Inc.	N	<500->	3600		>2000	<.2		N	< 1.>1	0	>200
Parker Hydraulies Div. Parker-Hannifin Corp.	N	<200-	1800	5000		1.	4	-	-		-
Perfection Steel Body Co.	N		1800	1500		_		_	_		_
Pesco Products Div. Borg-Warner Corp.	Y	<200->	3600	5000		<.5-	4	Y	< 5- 2	0	<400->20
Precision Hydraulics Div. Owatonna Tool Co.	N	>	1800		>5000	1		_	-		-
Racine Hydraulies & Machinery Inc.	Y	< 500-	1800		>5000	10-	>15	N	30- 6	0	<150->20
Rockwell Mfg. Co. Hydraulies Div.	N	<200-	1800	500-	1000	10-	>15	N	5->6	0	< 50->20
Roper Hydraulies Inc.	N	<200-	3600	1000-	2000		>10	N	5- 1	0	<150- 10
Sargent Engineering Corp.	N	<200->	3600	500		4-	7	N	< 5->2	0	<150->20
Sundstrand Hydraulies Div. Sundstrand Corp.	Y	<500->	3600	500-	3000	.2-	4	Y	< 5- 8	0	< 50->20
Tapco Group Thompson Ramo Wooldridge Corp.	N	<500->	3600	1000-	1500	.2-	2	-	_		-
Texas Hydraulies Inc.	Y	<200->	1800	3000-	5000	< 1-	>15	Y	5->8	10	<150->20
Thompson Ramo Wooldridge Inc. Michigan Div.	N	<500->	3600	500-	>1000	1-	2	-	-		-
Tuthill Pump Co.	N	< 500-	1800	1000-	2000	.2-	2	-	_		_
Vickers Inc.	Y	<200->	3600	500-	5000	<.5-	>15	Y	< 5- 4	000	< 50->20
Viking Pump Co.	N	<200-	3600	500-	1000	<.2-	>10				_
Warren Pumps Inc.	N	<200-	1800	1500			>10	_	_		_
Webster Electric Co. Oil Hydraulics Div.	N	< 500-	3600	2000		<.2-	>10	N	< 1.>1	0	<400->20
Weldon Tool Co.	N	< 500-	-	1000		.5		_	_		-
Wisconsin Hydraulies Inc.	N	<200-	1800	2000		4-	7	_	-		_
Wooster Div., Borg-Warner Corp.	N	<200->	3600	500	>2000	.2-	>10	N	>1	0	<400->20
Worthington Corp., Oil City Div.	N	<200-	1800	500-		2-	>15	_	_		armeter .
Zeno Hydraulie Corp.	N	<200-	1800		>1000	2-	>15	N	30->	50	< 50- 15

Notes: All manufacturers listed in this table make fixed-displacement units falling within the ranges indicated. Some also make variable-displacement units. This is indicated by Y in the column headed VD. N indicates no variable-displacement pump or motor is made.

< = Less than > = More than

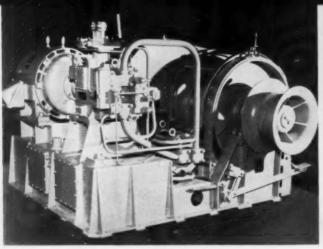


FIGURE 6a

Fig. 6. Split hydrostatic transmission, a, drives a cargo winch for shipboard use. The unit has an intermittent maximum hp rating of 180, at 1200 rpm, with 3000 psi operating pressure. Pump is variable displacement; motor is fixed displacement. Transmission pictured at b has pump and pump drive motor mounted away from the hydraulic motor. Photo a, courtesy Vickers Inc., photo b courtesy Oilgear Co.



Fig. 7. Torque-hp curves for a hydrostatic transmission using a variable-displacement pump and fixed-displacement motor.



Fig. 8. Torque-hp curves for a fixed-displacement pump—variable-displacement motor combination.



Fig. 9. Torque-hp curves for variable-displacement pump and motor combination.

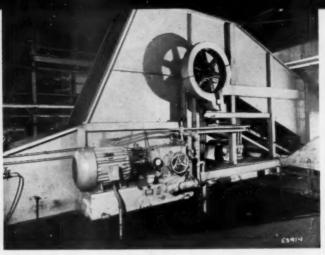


FIGURE 6b

HYDROSTATIC TRANSMISSIONS continued

the rotating mass is extremely small and inertia is low. Other advantages are:

- Small size—Volume of hydrostatic units is less than many of the alternative systems.
- Low weight—Lb/hp ratio can be well below 2 lb/hp and rarely exceeds 10 lb/hp.
- Control ease and accuracy—very accurate speed regulation is possible. Manual, power and servo controls are commonly available. Remote control is easy.
- Long life—Moving parts are well lubricated by the hydraulic fluid.
- Inherent overload protection—Pressure limiting device which is always part of the system limits output torque, lets units be stalled with no damage.

Applications

Characteristics of hydrostatic transmissions suit them to a wide variety of uses. Typical applications which really take advantage of these characteristics are high performance servo systems which require fast response speeds and reversing. Perhaps the best example of such a system is found in the constant-speed alternator drives used in aircraft.

Of course, hydrostatic transmissions are used in many other less glamorous places. Any job where high shock loads, overloads, stalling, frequent speed changes, or frequent reversal might be best performed by this type of transmission.

Table II -- Unit Hydrostatic Transmission Characteristics*

Manufacturer	Input** speed (rpm)	Output** speed (rpm)	НР	Torque (lbin.)
Crofts U.S.A. Inc.	1420	1090-1600	.25-21.5	17-1450
Oilgear Co.	1140-1750	1440	3-25	135-1880
Vickers Inc.	1800	1750	1	28-40

^{*}All unit transmissions have constant torque characteristic, see Figure 7.

^{**}These are maximum values. Output speed is continuously variable to zero.

Planned obsolescence

... how it affects power transmission system design

AN ESTIMATE of useful, or expected life, of a machine is an extremely important consideration when selecting or designing machine drive components. When you have a program of planned product obsolescence, it becomes even more important. Such a program cannot succeed unless the price of the product, whether a consumer item or a piece of production machinery, is consistent with its useful life.

No attempt will be made here to justify the philosophy leading to a program of planned obsolescence. It exists; it must be recognized, and lived with.

So, the question to be answered is: How shall the power transmission system be designed to fit the program? The answer is extremely simple when broadly stated. Find out how long the product is supposed to

last, add an appropriate safety factor, and design or select all power transmission components to last that long. In detail, the problem is more involved.

Determining Component Life

Manufacturers of most components such as bearings, belts, chain, sprockets, gears, etc. publish life data based on a certain load, speed, and number of expected hours of operation. They may also publish tables, curves and formulas to let engineers modify the basic data to fit other load values and speeds. Figure 1 shows how load values for antifriction bearings may be increased as life is reduced.

Data used in the selection of chain and speed reducers to meet particular service conditions is shown

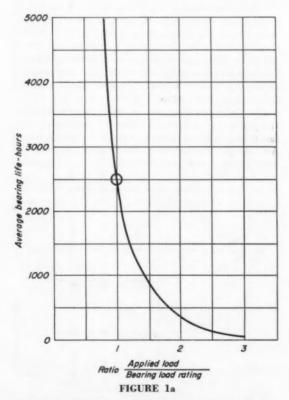
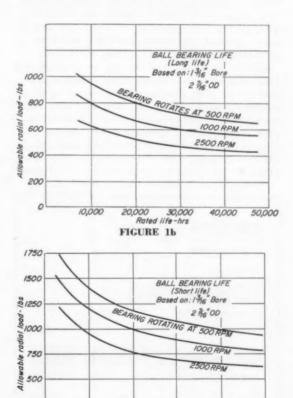


FIG. 1. A GENERAL CURVE of bearing life vs. load, a. This shows that for short life applications, load may be increased considerably. Speed also has an appreciable effect as shown by b and c. These curves are for 1-3/16 in. bore, 2-7/16 OD ball bearings.



250

2000

4000

6000

Rated life-hrs

FIGURE 1c

8000

10,000

Table I-Roller Chain Service Factors*

Type of load	Service conditions	10-hr day	24-hr day	
Uniform	Average	1.0	1.2	
Moderate shock	Abnormal	1.2	1.4	
Heavy shock	Abnormal	1.4	1.7	
Load reversals	Abnormal	1.5	1.9	

^{*}To be used with chain selection tables to provide 15,-000 hr average life.

PLANNED OBSOLESCENCE continued

in Table 1 and Table 2. Data for roller chain is based on an expected life of 15,000 hours. For low speeds and short life, the rating may be increased as much as seven times. The point to be remembered here is that load ratings are based upon a certain life which may be far more than is really required.

Procedures for calculating gear strength required vs. life are well covered in AGMA standards. However, these standards are based on the use of certain materials which may under almost any conditions give life far beyond that required in many applications. In such cases the use of other materials should be thoroughly investigated. For example, ductile irons are being suggested as a gear material worth considering. Also, plastics such as nylon are now being used in many light-load applications where they may have an additional advantage of not requiring lubrication.

There's no point in designing housings, motor bases, and other such structural components for lifetime service when other components are designed or selected for much shorter life. Also, by proper material selection, it may be possible to eliminate or reduce peak stresses which might have to be considered. A material with high vibration damping capacity, Fig. 2, but not necessarily high strength may be more practical. This way the stress peaks which might be met

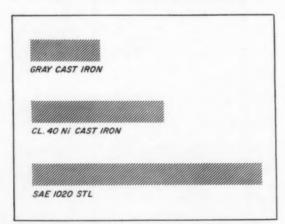


FIGURE 2a

FIG. 2. RELATIVE VIBRATION damping characteristics of two types of cast iron and a low-carbon steel, a. S-N diagram, b, shows the material with lowest damp-

Table 2—Service Factors for Speed Reducers

Prime mover	Service duration	Load Uni- form		High shock
Electric	Occasional (½ hr/day)	0.50	0.80	1.25
motor	Intermittent (3 hr/day)	0.80	1.00	1.50
	To 10 hr/day	1.00	1.25	1.75
	24 hr/day	1.25	1.50	1.75
Engines,	Occasional (1/2 hr/day)	0.80	1.00	1.50
multi-	Intermittent (3 hr/day)	1.00	1.25	1.75
cylinder	8-10 hr/day	1.25	1.50	2.00
	24 hr/day	1.50	1.75	2.00
Engines,	Occasional (1/2 hr/day)	1.00	1.25	1.75
single	Intermittent (3 hr/day)	1.25	1.50	2.00
cylinder	8-10 hr/day	1.50	1.75	2.25
	24 hr/day	1.75	2.00	2.25

Note: Maximum momentary or starting load for occasional and intermittent service must not exceed 200% of reducer rating. (Rating = service factor of 1)

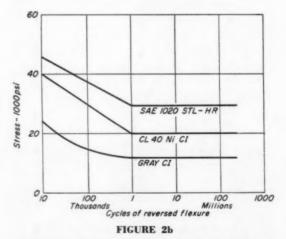
while passing through a critical frequency can be so reduced that a material with lower and more predictable endurance can be used.

Other Considerations

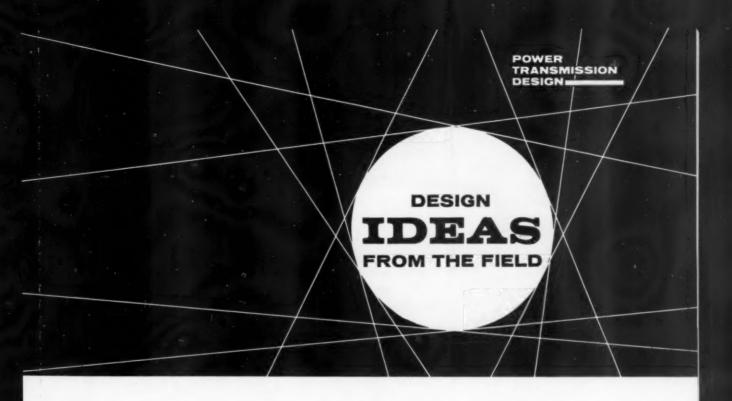
One further thought worth considering is the use of nonstandard components. Ordinarily, a standard component costs less than something special. This is particularly true when production quantities are small. However, when large quantities are to be bought and a standard component has life far beyond that needed, it may pay to have a special component produced to the required specification.

The designer's ingenuity in discovering and using cheap, readily available substitutes is another big factor in producing a product to meet the objectives.

An example: the use of rubber O-rings as belts for transmitting power in small drives.



ing to be most resistant to flexure, but cast iron could be a better housing material since it limits vibrational stress by its natural damping ability.



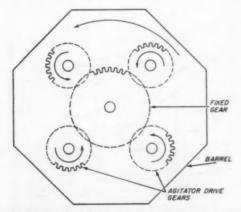
Stationary V-belt drives agitators

AN ABRASIVE mixture of sand, sawdust, and bits of leather used in a tumbling process did a fine job of deburring and polishing the pieces being processed. It also did a fine job of destroying the gears used to drive four agitators in the barrel and their bearings. This system consisted of one fixed gear and four gears on the ends of the agitator shafts which meshed with the fixed gear. As the barrel rotated, the four gears in mesh with the fixed gear turned the agitator shafts.

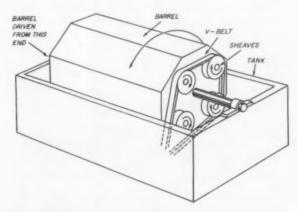
The idea which solved this problem was to use sheaves on the ends of the agitator shafts and drive

them with a V-belt. The V-belt is simply wrapped around the four sheaves and the end of the loop pulled over to the side of the tank and anchored. Thus, as the barrel revolves, the sheaves in contact with the fixed belt rotate the agitators. There is a short period when the sheaves are disengaged from the belt, but this does not affect the finish of the parts. Treated lignum vitae bearings are used for the sheaves.

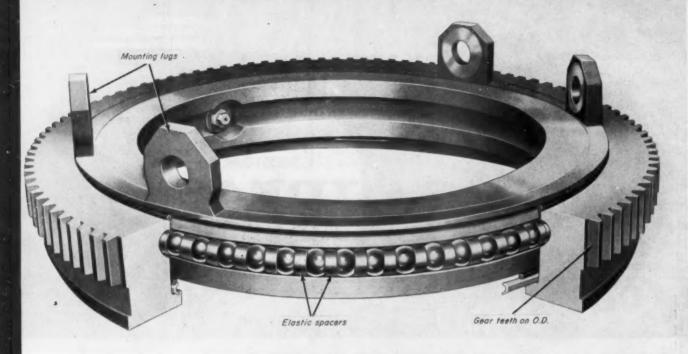
Users of this drive, Steel Heddle Mfg. Co., Philadelphia, Pa., say it is quieter, costs less, and has much longer life than the gears it replaces.



GEARS AND BEARINGS of tumbling barrel agitator drive were quickly destroyed by abrasive mixture used.



STATIONARY-V-BELT and sheaves with lignum vitae bearings are quiet, inexpensive, have relatively long life.



LARGE BALL BEARING performs complete turntable function.

Bearing eliminates turntable accessories

LARGE BALL BEARING is the only turntable connection in a new line of shovel-cranes. The bearing carries all the weight and forces of the shovel super-structure, both axial and radial. It eliminates hooks, center pin and nuts, roller path, centering gudgeon and other conventional accessories.

The bearing consists of two circular rings with hardened steel balls sealed between them. Outer ring is integral with ID of the ring gear. Inner ring has lugs which attach to the turntable bed. The balls, therefore, are the only connecting members and carry all the load.

Less power loss, longer life, and less maintenance are afforded. The balls are spaced with elastic separators. Lubrication is the only service needed. The large complement of balls keeps stress on any one ball low so that no appreciable wear results after

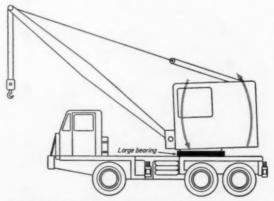
Gear teeth on outer race Large bearing

BEARING AS TURNTABLE eliminates center pin, hooks, roller path and other connections.

long service. Larger lifting capacities are thus realized over previous models.

Seals are located at top and bottom and are made of grease-resistant Neoprene. The seals float to adjust to every motion between the rings. Grease fittings are located around the circumference of the bearing for high-pressure gun application.

Designed and marketed by *The Thew Shovel Company*, Lorain, Ohio, the shear ball mount is used on the company's own line of crawler and rubber tire shovels and cranes.



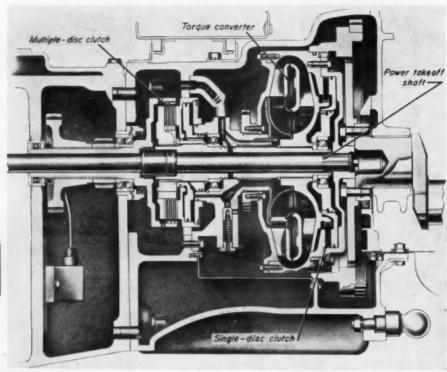
TURNTABLE RING GEAR is integral with bearing OD. Hardened, precision balls transmit all forces between shovel and truck.

10,000 CONFIGURATIONS – EACH WITH 10,000 SPEEDS!

Choose from thousands of different shapes, sizes, attitudes, mountings, horsepowers, enclosures, ungeared or geared combinations—choose the U.S. VARIDRIVE MOTOR that exactly fits your application! U.S. introduced the *first* self-contained a.c. motorized variable speed drive for industry—in 1932! Ever since, U.S. design engineers have been developing new Varidrives to combine new characteristics...new controls, too: Manual, mechanical, electrical remote control, and automatic control. Ratings available: ¼ to 75 h.p. (Send for free 16-page color Varidrive Bulletin, No. F-1797.) For your variable speed application, specify:

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IDEAS

POWER TAKEOFF connection directly to the flywheel is shown in this cutaway view of the torque converter-clutch unit of the Case-o-matic drive.

Torque converter-gearbox combination is versatile tractor drive



TORQUE CONVERTER-GEARBOX drive or direct drive through gears may be selected with the Case-o-matic drive used on this Case model 830 tractor.

HIGH EFFICIENCY, easy handling, and 16 different speed ranges are combined in the drive system used on a line of farm tractors. The drive is made up of a to true converter, an 8-speed change gearbox, and two oil actuated clutches.

A multiple-disc, oil-cooled clutch is used to engage or disengage the torque converter output shaft from the gearbox. A single-disc clutch is used to lock the flywheel directly to the the converter turbine and thus bypass the torque converter. The single-disc clutch is controlled by a valve actuated by a small lever mounted on the steering column. A conventional pedal is mounted for controlling the multiple disc clutch. However, the pedal is used to operate a valve which directs oil to engage or disengage the clutch.

Another feature of this drive unit is straightthrough power takeoff drive. This means that the power takeoff is driven directly from the engine flywheel at engine speed regardless of forward speed of the tractor. When the torque converter is engaged,

CONE-DRIVE WORM GEAR **HOLLOW SHAFT** SPEED REDUCERS

provide greater flexibility in the design of your equipment



Standard Cone-Drive hollow shaft speed reducers are available in four basic sizes (2, 2½, 3 and 3½ inch center distance units) to accommodate loads from fractional to 13 horsepower. They are built around the double-enveloping worm gear design and carry the same high ratings as standard Cone-Drive speed reducers.

You, as a designer, will be particularly interested in the versatility of application and space savings made possible by the right angle design between input and output shafts.

The reducer is mounted directly on the driven shaft and requires only a simple bracket or torque arm to prevent it from rotating about the driven shaft.

Construction is rugged enough to permit floor or wall mounting of Cone-Drive hollow shaft reducers and "hanging" the driven shaft on it (in certain applications), eliminating pillow blocks or bearings. Larger-than-necessary taper roller bearings and heavy-duty castings make this possible.

If a motorized reducer is desired, a simple, standard bell housing can be furnished for NEMA C-type face motors. The need for expensive couplings is eliminated since a tang-type drive sleeve and suitably machined worms are provided. When a hollow-shaft speed reducer and face-mounted motor are combined, no bed plate or mounting arrangement is required. Pulleys, belts, sheaves, etc., that might be troublesome or diffi-cult to install are also eliminated.

Ask for Bulletin CD-218.



CONE-DRIVE GEARS DIVISION MICHIGAN TOOL COMPANY

7171 E. McNichols Road . Detroit 12, Michigan . Telephone: TWinbrook 1-3111



WELDING POSITIONER

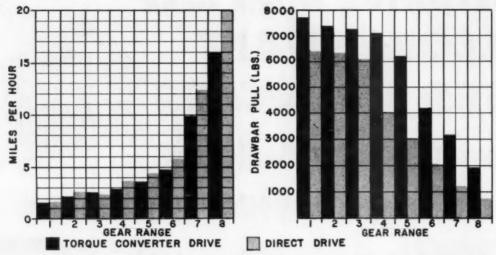






DUBLE-ENVELOPING DOUBLE-ENVELOPING WORM DE DOUBLE REDUCTION WORM DOUBLE-ENVELOPING WORM GEAR SPEED REDUCERS GEAR SPEED REDUCERS

Circle No. 59 on Reader Service Card



SIXTEEN different forward speed ranges are available from the Case-o-matic drive when an eight-speed gearbox is used.

TORQUE CONVERTER-GEAR BOX continued

the tractor automatically slows down or speeds up with changes in load, but power takeoff speed will remain constant as long as engine speed does. Torque converter multiplication ratio automatically changes from a maximum of 2.0:1 to whatever lower value may be required to drive the tractor.

This unit is used on the 530, 630, 730 and 830 series tractors, as well as others made by the J. I. Case Co., Racine, Wis. The manufacturer calls it the Case-omatic Drive.

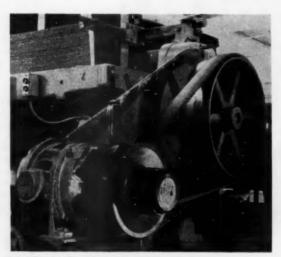
Wide-range V-belt drives flat pulley

A VARIABLE-PITCH sheave and wide range V-belt replaced a block belt variable-speed drive on a partition slotter at about the same price as a new, specially-made belt for the old drive would cost. The variable-pitch sheave is mounted on the motor shaft and drives to a flat pulley on the machine. A handwheel regulated sliding motor base is used to vary speed.

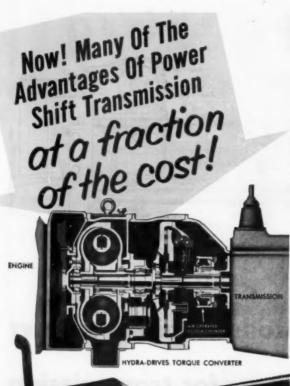
Because the old belts were expensive, specially-made, and had to be ordered well in advance of delivery, there are several advantages to this modification. The wide-range belt costs less than the other, is quickly obtainable from dealer stock, and has predicted life of about three times that of the other. Speed range was also increased. Another advantage is easy adjustment. This is important because the machine is tended by three girls and speed changes are made often.

Drive motor is 5-hp, 1150-rpm at full load. Diameter of the variable-pitch driving sheave is variable from 4½ to 12¾ in. Driven pulleys is 21-in. diameter,

This drive change was made by Superior Paper Products Div., St. Regis Paper Co., Mount Wolf, Pa.



WIDE RANGE V-belt driving flat pulley greatly improved the drive on this partition slotter. Photo, courtesy T. B. Wood's Sons Co.



HYDRA-DRIVES°

TORQUE CONVERTER WITH A STICK SHIFT TRANSMISSION!

Lower in initial costs, Rockwell-Standard's Hydra-Drives Converter with stick shift transmission reduces operating and maintenance costs on heavy-duty off-highway trucks. You get these five major advantages plus many others:

- 1. Up to 80% of shifting is eliminated. Select a transmission ratio to fit the haul, and let the converter handle the changing load conditions with a minimum of gearing. Any required shifting can be done while truck is in motion!
- 2. Greatly reduces shock loading on all drive components.
- Clutch adjustments and wear problems minimized.
- 4. A minimum of driver training is required.
- Cost is hundreds of dollars less than full power shift transmissions.

HYDRA DRIVES

ROCKWELL-STANDARD CORPORATION
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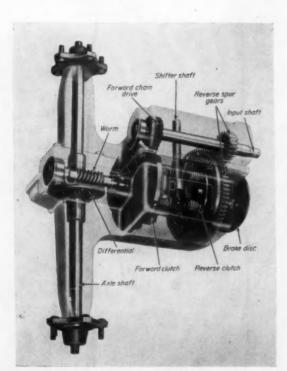
ANOTHER PRODUCT OF ROCKWELL-STANDARD CORPORATION

Axle shaft

Differential

IDEAS

Roller chain is quieter than gears for transmission



PHANTOM VIEW of transmission unit for platform truck.

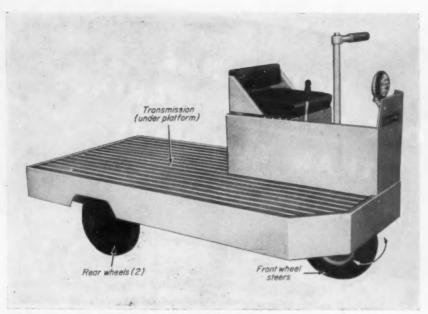
ROLLER CHAIN IS USED for forward drive reduction in the transmission of a new platform truck. Double width of chain provides smoother, quieter operation than is possible with spur gears. The transmission has differential and axle shafts built into the same housing with the forward and reverse reduction unit.

Low cost, light weight, compactness, and durability are essential for applications such as the small platform truck shown. A wide range of ratios permit top speeds of 3 to 18 mph.

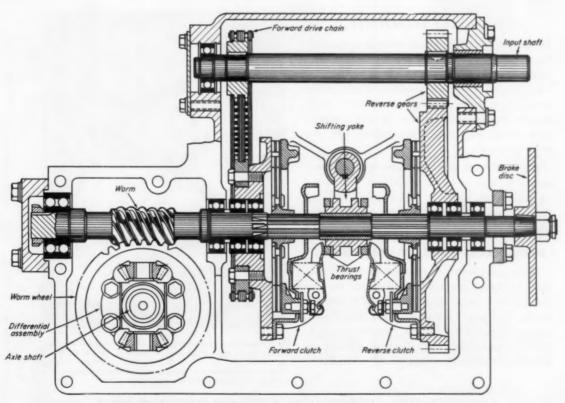
Forward may be in either direction so the unit can be used for front or rear-wheel-drives. Reverse gears and the forward chain drive are in constant mesh and are selected by engaging one or the other of two high-capacity friction clutches. Addendum of the reverse pinion is modified to permit operation at the non-standard center distance required by the chain.

This arrangement provides neutral in addition to forward and reverse. Engines from 7 to 18 hp may be used with the transmission. To facilitate servicing, the case is split in a vertical plane through the wormshaft of the differential unit. A brake disc mounted on the worm shaft provides ample braking for any vehicle using this unit.

Prime-Mover Co., Muscatine, Iowa, makes this power shift transmission and axle assembly. Two years were spent on design, development and field testing.



PLATFORM TRUCK uses unitized transmission-differential with dual chain for quiet forward drive,



TWO FRICTION CLUTCHES engage and disengage forward and reverse drives.

DODGE HAS MORE PROVED BEARINGS THAN YOU HAVE BEARING PROBLEMS!

bearings—bearings that have been proved in thousands of installations similar to yours. You benefit by getting known dependability; and you get the important savings of high quality at production price.

PIN-POINT SELECTIVITY

Dodge has supplied mounted bearings to industry for over three-quarters of a century. Dodge bearings have always kept pace with improved production practices. Each new condition of service has been met by Dodge as it has arisen, with the result that the Dodge line contains mounted bearings to meet almost every service requirement with pinpoint accuracy.

High load, high speed, excessive dust, moisture, corrosion, high or low temperatures, continuous operation—you name it!—such conditions and their combinations are met every day with Dodge bearings.

BROAD LINE-WIDELY DISTRIBUTED

In the great variety of mounted bearings developed by Dodge, you will most likely find the precise unit to fit your requirements ideally—without paying for features you do not need. And if your requirements call for several types of bearings, there is an advantage in having them of common design, such as Dodge offers.

The Dodge line is probably broader than any other line of mounted bearings in America. And of special importance to machinery manufacturers, it is the most widely distributed line. There is always a Dodge bearing of the right type and size near at hand.

You can check this with your local Dodge Distributor. Ask him—or write us for the Dodge Bearing Bulletin.



In addition to tapered roller, spherical roller and ball bearings, Dodge builds many types of sleeve bearings. Here is the "large and small" of the sleeve type bearings carried in stock—ranging from an 8-in. Sleevoil weighing over 1200 lbs. to a ½-in. solid journal bearing weighing 9 ounces.

DODGE MANUFACTURING CORPORATION, 8200 Union Street, Mishawaka, Indiana



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PILLOW BLOCKS



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PILLOW BLOCKS



DODGE JOURNAL BEARINGS SOLID AND SPLIT

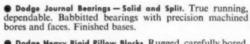


PILLOW BLOCKS



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- Dodge Sleevoil Pillow Blocks. Ultra quality . . . extra long life . . . accessibility . . . quiet. Plain or water-cooled.
- Dodge Bronzoil Pillow Blocks. Efficient, low cost pillow blocks with self-oiling, capillary bronze bushings. Self-aligning. Large oil reservoirs.
- Dodge Bronze Bushed Pillow Blocks. Quiet fan and blower pillow blocks with two bronze bushings of high lead content mounted in one cast iron housing.



- Dodge Heavy Rigid Pillow Blocks. Rugged, carefully bored, babbitted pillow blocks for many applications requiring grease lubrication. Finished bases and ends.
- Bearing Units. A wide variety—spherical seat, cartridge, flange, hanger, screw conveyor hanger, take-up. Ball, Roller and Sleeve types.

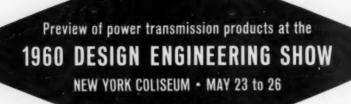


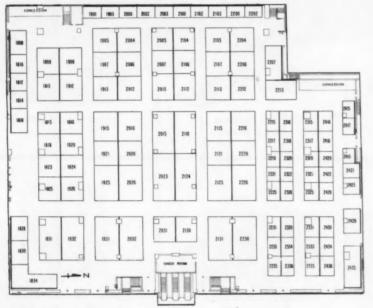
CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioner" in the white pages of your telephone directory, or the yellow pages under "Power Transmission Machinery."

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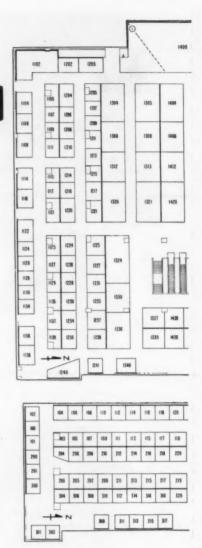
of Mishawaka, Ind.

Circle No. 17 on Reader Service Card





FIRST FLOOR



Pneumatic hose

Has a Teflon tube, which does not absorb moisture, for easy dehydration. Spirally-wound stainless steel wire overlaying a stainless inner braid reinforces the hose. Designed for 6000 psi systems, it has a 24,000 psi burst pressure.

Aeroquip Corp., Jackson, Mich., Booths 1809, 1908.

Circle number 200 on reader service card

Adapter bearings

Bearings are for shaft sizes ½ to 1¼ in. Flange and outer bearing race are a one-piece unit which needs no pre-installation assembling. Shaft

misalignment compensation is up to $\frac{3}{8}$ in. per ft. The bearing is protected by one piece Buna-N seals which maintain positive contact under all conditions of misalignment. Inner and outer bearing races are case hardened to resist shock load. Mounting flanges are heavy gauge pressed steel.

Aetna Ball & Roller Bearing Co., Chicago, Ill., Booth 927.

Circle number 201 on reader service card

DC transistorized drive

Thirteen "building block" control circuits can be added as required to this drive. Circuits come on 6 x 6

in. fiberglass panels ready for installation. Adaptations can be done in the plant at low cost.

The Louis Allis Co., Milwaukee, Wis., Booths 1712, 1714.

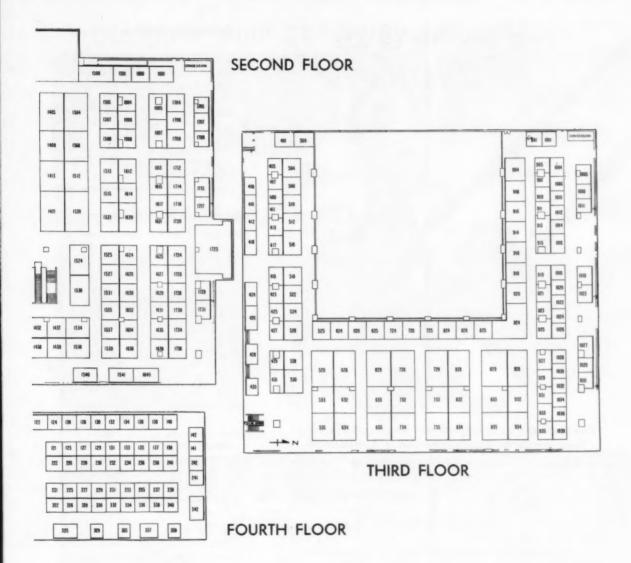
Circle number 202 on reader service card

Aluminum bearing bond

Pressure bonding of aluminum bearing alloys to high strength aluminum castings and forgings makes possible an aluminum part with high strength and a surface having good bearing characteristics.

Aluminum Co. of America, Pittsburgh, Pa., Booth 2032.

Circle number 203 on reader service card



To get complete information on these products, use the Reader Service Cards bound into this issue.

Bronze alloy

For all press operations except blanking. Said to offer exceptional toughness and resistance to impact, good machinability and wear resistance. Scratching, galling, and loading are almost eliminated. Can be cast to shapes required—also available in 66



stock sizes as centrifugally cast rings, rounds, and rectangles.

Ampco Metal, Inc., Milwaukee, Wis., Booth 1612.

Circle number 204 on reader service card

Air bearing

Shaft is floated on compressed air introduced through apertures in the wall of the bearing. Use of Oilite powder metal with a porous bearing surface gives a uniform distribution of air through the entire ID. Result is a nearly frictionless bearing.

Amplex Div., Chrysler Corp., Detroit, Mich., Booth 1125.

Circle number 205 on reader service card

Tiny differentials

Ten standard models are available with shaft sizes from 1/16 to 5/16 in. Hollow shaft models are 1/16, 1/8, and 3/16 in. Solid shafts are 1/8, 3/16, and 5/16 in. Parts are carried in stock.

Arch Instrument Co., Inc., North Quincy, Mass., Booth 222.

Circle number 206 on reader service card

Plastic bearings

Composed of plastics, compression molded with synthetic and dry lubricants. These are released by heat to the bearing surface, re-absorbed



Revolutionary, All-Synthetic Belting Is Proving Superiority In Application After Application

Dixylon has established new concepts in belting performance, value, versatility . . . the swing is to Dixylon for heavy and light power transmission, for high speed, machine tool drives, printing tapes, spinning tapes, conveying belts, numerous other uses. Check these advantages . . .

Stretch-free—runs for years without idlers or take-up.

High Tensile Strength—very thin Dixylon belting can be used at amazingly high speeds, and for small pulley diameters.

Great Durability -- gives long, maintenance-free service

Non-Slip—high frictional coefficient . . . no belt dressing required.

High Resistence to oils, greases, most acids. Nonabsorbent.

A Special Dixylon Plus Value . . . Can Be Made Endless

In Minutes Without Lacing Or Sewing-

The speed and ease with which Dixylon can be joined saves downtime, reduces need for carrying large stocks of endless belting.

R. & J. Dick

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Circle No. 15 on Reader Service Card

DESIGN SHOW PREVIEW continued

as the bearing cools. Material can be machined to precision tolerances. Company offers a standard line of cylindrical bearings and a self-aligning package unit with this material as the bearing surface. Bonded with steel, it gives a shaft collar with a low friction thrust bearing surface.

Arguto Oilless Bearing Co., Philadelphia, Pa., Booth 1015.

Circle number 207 on reader service card

Motorized speed reducers

A line of helical geared speed reducers for in-line drives includes new small units for the 1/6 to ½ hp range. Larger units provide a full



selection of ratings up to 10 hp. Reducers can be horizontal base mounted, vertical base mounted, or shaft mounted.

Boston Gear Works, Quincy, Mass., Booth 1808.

Circle number 208 on reader service card

Bearing units

A line of re-lube type bearing units includes high and low pillow blocks, 4 and 2 hole flange units, and take-up units. Most units are available in 29 shaft sizes from 1/2 to $2 \cdot 7/16$ in. All have malleable housings.

Browning Mfg. Co., Maysville, Ky., Booth 2207.

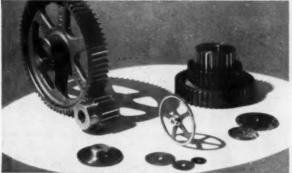
Circle number 209 on reader service card

Right angle gearmotor

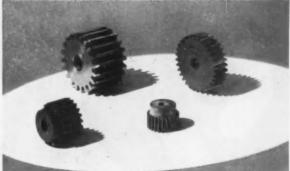
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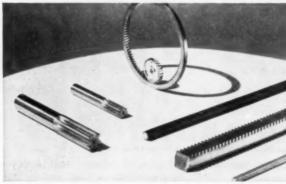
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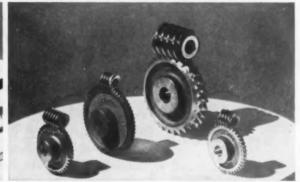
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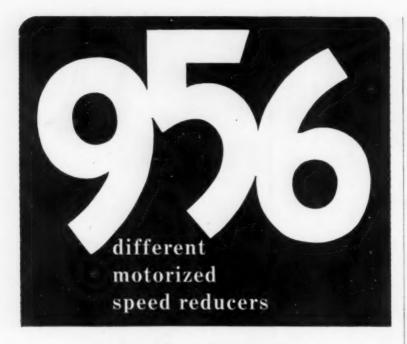






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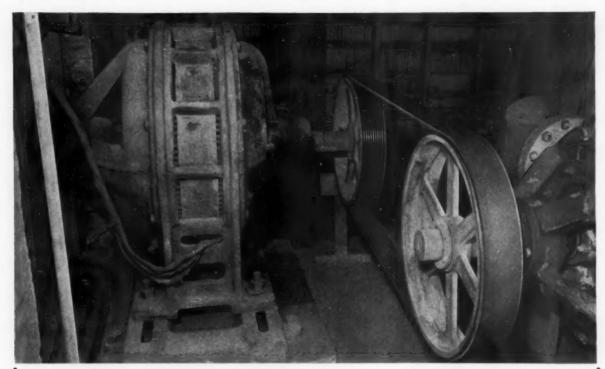
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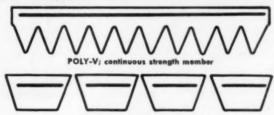
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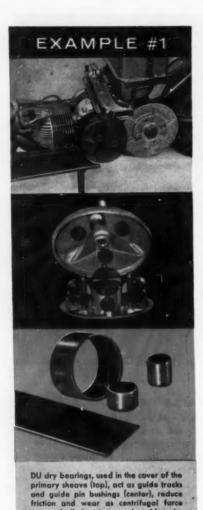
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continued on page 61

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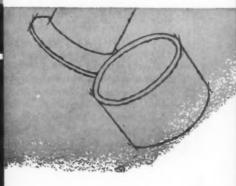
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Determining bearing loads

. . . due to power transmission

WITH FEW EXCEPTIONS total load on a bearing is the sum of several radial and thrust loads. The most common load sources are:

- · Dead weight
- Centrifugal forces
- Inertia loads
- Propellor thrust
- Hydraulic forces
- Forces from power transmission

This article will cover ways to find loads resulting from power transmission.

With the torque or horsepower being transmitted known, only the tangential bearing load component can be computed. This is the force which produces the torque transmitted. All other load components are found from this tangential component and other data fitting the case.

Pulleys, Sheaves, and Sprockets

Bearing loads from power transmitted through flat belts and pulleys, V-belts and sheaves, and chain and sprockets are all calculated similarly. First, the tangential component P is computed from

$$P = \frac{T}{r} \tag{1}$$

where T = torque, lb-in.

r = pitch radius, in.

Then, the resultant load on the shaft, R, is computed from

R = kP(2)

- where k = 1.00 for chain with no tighteners = 2.00 for V-belt drives, and rope drives under average conditions with 45 deg included angle pulleys
 - = 2.25 for flat belts with normal tension
 - = 3.00 for flat belts with high tension, and ropes with high tension or pulley grooves to 60 deg included angle

The constant, k, allows for differences in tension with the different types of drives. Resultant load is parallel to and in the same direction as the belt pull. Fig. 1.

With the total load due to a drive of this type determined, resulting individual loads on the bearings are found using moment summing methods. For example, if the reaction $R_{\rm s}$ from the sheave shown in Figure 2 has been found to be 1400 lb, the reaction, or

load on bearing a is found by summing moments about bearing b. Thus,

$$R_a \times b = 1400 \times (b+c)$$

01

$$R_a = \frac{1400 \times (b+c)}{b}$$

where R_a = reaction on bearing a, lb

b, c = distances shown, in.

Load on bearing b is found by summing moments about bearing a. If distances c and b equal 6 and 8 in., respectively, the reactions on the bearings are

$$R_a = \frac{1400 \times (6+8)}{8} = 2450 \ lb$$

$$R_b \times b = R_s \times c, R_b = \frac{R_s \times c}{\frac{b}{1400 \times 6}} = \frac{1400 \times 6}{8} = 1050 \text{ lb}$$

Load on the second bearing might also have been found by summing the reactions at the sheave and the bearings. The sum of these must equal zero. Of course, their direction must be considered and positive values assumed for forces in one direction, while forces in the opposite direction are considered negative. In this case,

 $R_s + R_a + R_b = 0$, 1400 + (-2450) + 1050 = 0Actual bearing load is equal in magnitude to the reaction at the bearing but opposite in direction.

Spur Gears

Here there are two forces which must be computed.

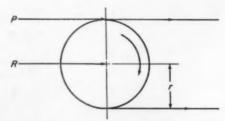


FIG. 1. FORCE on a shaft resulting from power transmission with chain, belts, or ropes acts at the center of the sprocket, sheave, or pulley. Direction of the force is coincident with the line joining the centers of the sprockets, sheaves, or pulleys.

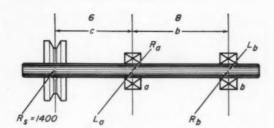


FIG. 2. BEARING REACTIONS due to power transmission with belts, sheaves, or pulleys are found by summing moments and forces. Bearing loads equal the reactions and are opposite in direction.

First is the tangential force which is found from Equation 1; second is the separating force, S, at right angles to the tangential force, see Fig. 3. Separating force is dependent upon the pressure angle of the gear teeth and is related to the tangential force by

 $S_s = P tana$ (3) where a = gear tooth pressure angle

Helical Gears

In addition to the forces present with spur gears, thrust is present with helical gears. Tangential force is found from Equation 1. The equation for separating force is modified by the helix angle so

$$S_h = \frac{P_h \tan \alpha}{\cos \gamma} \qquad (4)$$

where $\gamma =$ the helix angle

Thrust is a function of the tangential force and the helix angle. They are related by

$$F_t = P_h \tan \gamma$$
(5)

Since the thrust load is at a distance equal to the pitch radius from the center of the shaft, it produces a moment, $F_t \times r$, which contributes an additional radial load to the bearings. Direction of the thrust load depends on whether the helix is right or left hand and the direction of rotation of the gears, Fig. 4.

Example

To illustrate the use of the methods outlined, all computations for the system in Fig. 5 will be done.

First step is to compute all loads on shaft 1. Torque is found from

$$T = \frac{63025 \times hp}{n} = \frac{63025 \times 5}{1200} = 262.5 \text{ in.-lb}$$

Sheave load from Equation 1,

$$P = \frac{T}{r} = \frac{262.5}{4.5} = 58.4 \text{ lb}$$

and, from Equation 2

$$R = k P = 2.00 \times 58.4 = 116.8 lb$$

This load acts upward at the sheave center.

Spur gear: Ignoring the dead weight of shaft 1, the only other loads on this shaft are due to the 4 in. diam spur gear. Tangential force is found from Equation 1.

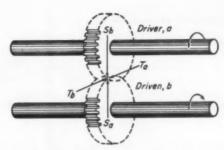


FIG. 3. SPUR GEARS have two force components tangential and separating. Forces on each gear of the pair are equal and opposite. Separating force tries to push the gears apart. Tangential load direction is determined by remembering that it produces the rotation of the driven gear and is opposite for the driving gear.

$$P_a = \frac{T}{r} = \frac{262.5}{2} = 131.25 \text{ lb}$$

Then separating force is found from Equation 3. $S_a = P_a$ tana = $131.25 \times 0.259 = 34$ lb

Summing vertical loads: The separate forces must be resolved to find the reaction forces or loads at the bearings. First, loads due to R and S which act in the same direction are found by summing moments about bearing 2. (To satisfy equilibrium conditions, sum of the moments about a point must always be zero.) Thus,

$$R \times 5 + S_* \times 2 + R_1 \times 4 = 0,$$

 $116.8 \times 5 + 34 \times 2 + 4R_1 = 0$

or
$$\times 3 + 34 \times 2 + 4 \times 1 = 0$$

$$R_1 = \frac{-(116.8 \times 5 + 34 \times 2)}{4} = -163 \text{ lb}$$

The minus sign indicates that the bearing reaction is

Nomenclature

 $F_t = thrust, lb$

k = factor to allow for tension in

chain, belts, etc.

L = vertical bearing load, lb

L_P = tangential bearing load, lb

ΣL = total bearing load, lb

P = tangential force, lb

Ph = tangential force on helical

gear, lb

P_s = tangential force on spur gear,

R = bearing load from belt, chain, etc. drive, lb

r = pitch radius, in.

S_h = separating force on helical gear, lb

S_s = separating force on spur gear,

T = torque, lb-in.

a = gear tooth pressure angle

y = helix angle

DETERMINING BEARING LOADS continued

opposite in direction to the applied loads.

Reaction at bearing 2, or the load on that bearing due to the same forces can be computed in either of two ways. The first is to sum the forces acting in upward and downward directions. Again, for equilibrium, these must be equal. Using this method,

$$R_1 + R_2 + R + S_s = 0$$

$$-163 + R_2 + 116.8 + 34 = 0$$
, $R_2 = 12.2$ lb

 $-163+R_2+116.8+34=0,\,R_2=12.2\,\mathrm{lb}$ The positive value for R_2 indicates that the bearing reaction is upward, or that the load on the bearing is

The other method for finding this value is by summing moments about bearing 1. This should give the same answer and makes a good check.

Tangential load: Tangential load must be combined with the vertical loads found to find the total load and its direction. First step is to find the loads at both bearings due to tangential load. Again, the values are found by summing moments and forces in the plane of the tangential load. By solving

$$L_{T1} + L_{T2} + T = 0$$

and

$$L_{T1} \times 4 + 131.25 \times 2 = 0$$

values of these reactions are found to be 65.6 lb.

Total load: Vector sum of the tangential and vertical loads can now be found. These loads are at right angles to each other and are summed using the basic relationship for right triangles that the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the other two sides. Therefore, load on bearing 1 is

$$\Sigma L_1^2 = 65.6^2 + 163^2$$

or $L_1 = \sqrt{4300 + 26,500} = 175.5 \text{ lb}$

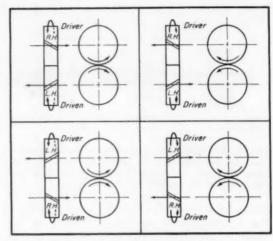


FIG. 4. THRUST DIRECTION with helical gear pairs is shown by this diagram.

and similarly, load on bearing 2 is

$$\Sigma L_2^2 = 65.6^2 + 12.2^2$$
 or $L_2 = \sqrt{4300 + 149} = 66.7$ lb

Shaft 2

For shaft 2, there are tangential loads due to power transmission, separating force from the spur and helical gears in mesh, and thrust load from the helical

Tangential load: Since other loads are determined from tangential load, these are found first. Spur gear tangential load is, of course, the same in magnitude as that of the mating gear on shaft 1. However, it is opposite in direction. To find tangential load from the

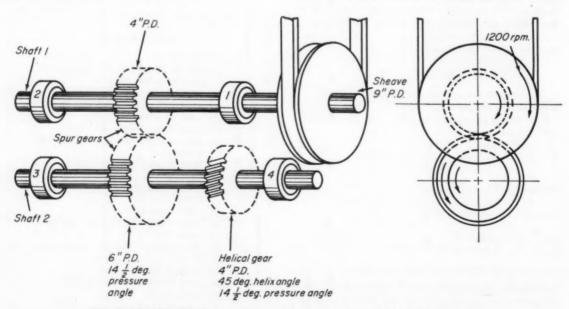


FIG. 5. BEARING LOADS in this hypothetical system are calculated in this article.



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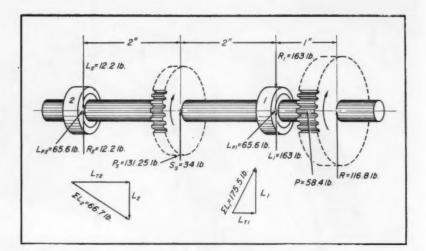


FIG. 6. FORCES and bearing loads on shaft 1 of the example.

DETERMINING BEARING LOADS continued

helical gear, torque input is computed from

 $T = Pr = 131.25 \times 3 = 393.75$ lb-in.

where P = tangential force of the spur gear on shaft 2 r = pitch radius of the spur gear

Then tangential force on the helical gear is

$$P_h = \frac{T}{-} = \frac{393.75}{-} = 196.88 \text{ lb}$$

Separating force on the helical gear can now be found from Equation 4.

$$S_h = \frac{P_h \tan a}{\cos y} = \frac{196.88 \times 0.259}{0.707} = 72.71 \text{ lb}$$

Separating force for the spur gear is the same as that previously computed for shaft 1.

Thrust force due to the helix angle of the helical gear must be found before the vertical loading on the bearings can be calculated since the moment it creates must be balanced by bearing reaction. Equation 5 supplies this value

Vertical loads can now be found on bearings 3 and 4. By summing moments about bearing 4,

 $F_T = P_h \tan y = 196.88 \times 1 = 196.88 \text{ lb}$

$$\begin{array}{c} R_3 \times 4 + S_{_B} \times 3 - S_{_h} \times 1 - F_{_T} \times 2 = 0 \\ R_3 = \frac{-3 \times 34 + 72.7 + 2 \times 196.88}{4} = 90.94 \text{ lb} \end{array}$$

In summing these moments, those tending to produce counter-clockwise rotation about bearing 4 were assumed positive. Therefore, reaction at bearing 3 is downward, and the load is upward.

By summing vertical reactions, reaction at bearing

$$R_4 + 72.7 - 34 - 90.94 = 0, R_4 = 52.3 \text{ lb}$$

Because upward force was taken as positive, reaction at bearing 4 is upward and the load is downward.

Tangential loads: bearing reactions due to the tangential loads are also found by summing moments and forces. Both helical and spur gear loads may be handled simultaneously. Thus,

$$\begin{array}{c} 4\,R_{P3} + 3\,P_s + 1\,P_h = 0, R_{P3} = \\ -3 \times 131.25 - 196.88 \\ \hline \\ \end{array} = -147.66 \text{ lb} \end{array}$$

Since tangential load of the spur gear was assumed positive, the negative answer shows that tangential reaction at bearing 3 is in the opposite direction, and load in the same direction.

$$R_{P4} = 131.25 + 196.88 - 147.66 = 180.47 \text{ lb}$$

Total load resulting from tangential and vertical loads can now be resolved. For bearing 3, this is

$$\Sigma L_3 = \sqrt{147.66^2 + 90.94^2} = 174 \text{ lb}$$

For bearing 4
 $\Sigma L_4 = \sqrt{52.3^2 + 180.47^2} = 185 \text{ lb}$

Other Gear Types

These methods for computing bearing loads work for all other types of gearing—that is, the methods for summing forces and moments, and resolving them. Equations for determining tangential load, separating force, and thrust vary with the type of gearing. Future articles similar to this one will cover load computations for other gear types.

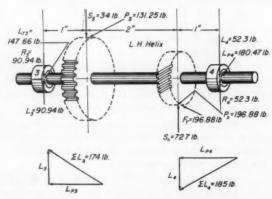
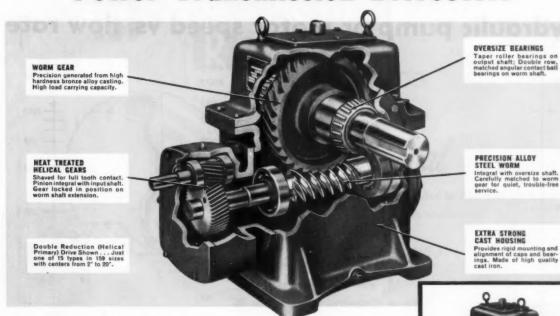


FIG. 7. FORCES and bearing loads on shaft 2.

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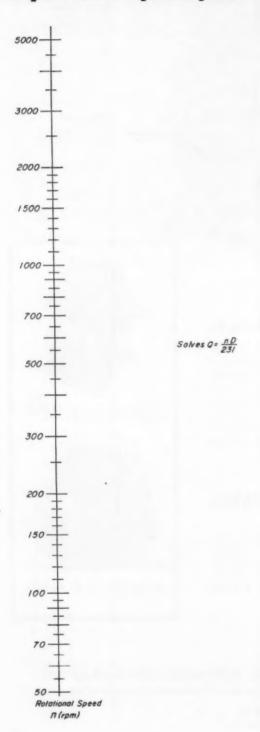
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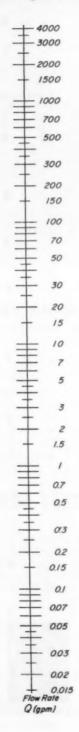
POWER TRANSMISSION DRIVES

Circle No. 65 on Reader Service Card

REFERENCE FILE

Hydraulic pump or motor speed vs. flow rate

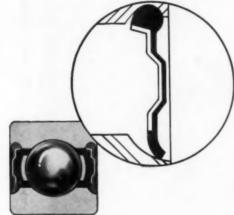






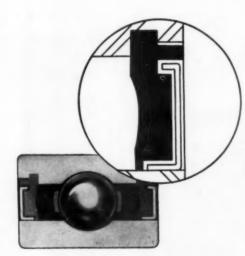
IN Sealed BALL BEARINGS

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MRC Synthe-Seal®:

- flexible synthetic rubber seal is bonded to steel core for strength
- keeps dirt and moisture out seals lubricant in
- resists operating pressures
- normal operating range from —80° F. to +225° F. Special materials available for higher temperatures
- reduces maintenance time
- satisfactory performance in thousands of applications
- best seal for AFBMA standard single-row width bearings



MRC Labri-Seal®

- · combines a rotating flinger and synthetic rubber labyrinth seal
- retains long life grease
- · prevents over lubrication and grease leakage
- metal flinger repels dirt and moisture and protects flexible synthetic rubber labyrinth seal
- operating temperatures from —80° F. to +225° F. Special materials available for higher temperatures
- recommended for use in the most adverse conditions of dirt and moisture
- ideal for low torque applications
- best seal available for cartridge width bearings

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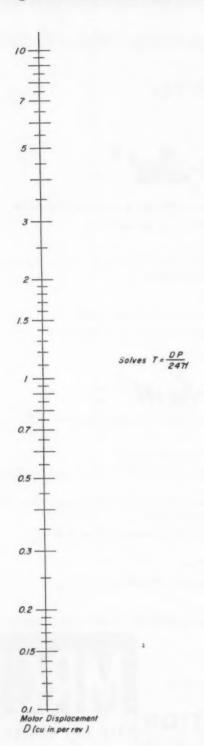
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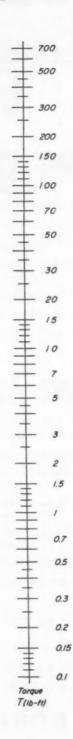
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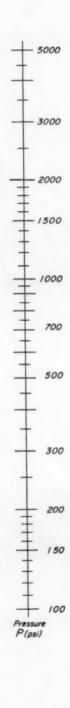
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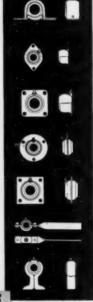
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LITERATURE on drives and components

To get free copies of the following literature, use the Reader Service Cards bound into this issue.

phase squirrel cage type are designed for two different applications. Bulletin MU-244 describes a pump motor, 1 hp or larger with NEMA "C" face plates for close coupling with centrifugal pumps. Bulletin MU-245 lists motor, 1/6 through 10 hp with resilient mountings for quiet operation Wagner Electric Corp., St. Louis, Mo.

Circle number 300 on reader service card

of laminated phenolic and aluminum alloy permit maximum speeds of 110,000 rpm with grease lubrication. Four-page data sheet gives details. The Barden Corp., Danbury, Conn.

SOLID LUBRICANT . . . said to greatly reduce galling, seizing, and metal pickup is recommended for a variety of uses. Free sample comes with Bulletin 126B. *Alpha-Molykote Corp.*, Stamford, Conn.

Circle number 302 on reader service card

ELECTRIC CONTROLS . . . 8-page Brochure P-75 covers standard, special, and custom controls for brakes and clutches. Dimension and selection data included. Warner Electric Brake & Clutch Co., Beloit, Wis.

Circle number 303 on reader service card

CATALOG NO. 160 . . . compiles 40 pages of data on high-speed indexing components for roller gear drives, in-line transfer machines, and related equipment. Includes tabulated load ratings and dimensions. Ferguson Machine Corp., St. Louis, Mo. Circle number 304 on reader service card

GEAR MOTORS . . . and motor reducers that can be coupled with any type of foot mounted motor are illustrated in 8-page Bulletin No. 198. Sterling Electric Motors, Inc., Los Angeles, Calif.

Circle number 305 on reader service card

MODERN GEAR CUTTING .

and grinding facilities are highlighted in a 12-page booklet. Tells about the advantages of hardened, precisionground gears. *Philadelphia Gear Corp.*, King of Prussia, Pa.

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FLOW REGULATORS . . . control flow of oil or fuel accurately to as low as 35 cc per minute. Circular and blueprint gives data. Fluid Power Accessories, Inc., Glenview, Ill.

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V-BELT . . . line includes 3 new dimensions with top widths of 3/8, 5/8, and 1 in. Detailed in Price Sheet V-358-A. Browning Mfg. Co., Maysville, Ky.

Circle number 308 on reader service card

TINY BRONZE BEARINGS . . . to precision instrument standards are shown in 4-page Design Catalog 60-61. Specifications and installation methods included. Northfield Precision Instrument Corp., Island Park, N. Y.

Circle number 309 on reader service card

BELTING . . . of various types and materials is covered in 24-page Catalog B-60. *Maurey Mfg. Corp.*, Chicago, Ill.

Circle number 310 on reader service card

CAPACITOR START MOTOR ...

with gear reduction is instantly reversible and gives full starting torque in either direction. Illustrated, with typical applications, in a 4-page pamphlet. Franklin Electric Co., Inc., Bluffton, Ind.

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V-BELT CATALOG . . . has 64 pages of general information, selection tables, hp rating tables, and matching data. Boston Woven Hose & Rubber Co., Boston, Mass.

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The roller in a roller chain must provide maximum resistance to its impact against sprocket teeth for longest wear life. A PLUS VALUE of Rex Roller Chains is really round rollers. This provides full bearing against the bushing for maximum life. For complete story, mail the coupon.



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Substantial Improvement in Reliability, Service Life

This new low-cost, lightweight Magneclutch retains and improves all the outstanding characteristics of the older model: no wear on torque transmitting surfaces, smooth operation, torque at zero slip, etc. Larger size Magneclutches axailable to 200 lb.-ft., water or air cooled.

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Circle No. 47 on Reader Service Card LITERATURE continued

TORQUE ARM REDUCERS . . .

and reducers for flange mounting, vertical shafts, right angle drives, and screw conveyor drives are described in 64-page Bulletin A692. Includes tabulated selection data and construction details, dimensions, and prices. Dodge Mig. Corp., Mishawaka, Ind. Circle number 313 on reader service card

STOCK ROLLER CHAINS . . . and sprockets of over 2000 types, including double pitch transmission and conveyor chains, are listed in a 44page booklet, No. 2757. Also has information on flexible couplings. Link-Belt Co., Chicago, Ill.

Circle number 314 on reader service card

AC MAGNETIC STARTER . . . has an arc quenching device said to provide longer contact life under heavy current loads. Illustrated in an 8-page bulletin, PL-12-8-60. Clark Controller Co., Cleveland, Ohio.

Circle number 315 on reader service card

STOCK SPUR GEARS . . . of 24 and 32 pitch, cut to AGMA precision Ic tolerances are available in bore sizes from 1/8 to 1/4 in. Supplement catalog No. 13 gives details. PIC Design Corp., East Rockaway, N. Y.

Circle number 316 on reader service card

DIFFERENTIAL . . . for drives up to 6 hp mounts on a single axle yet equalizes power to both wheels. Details of this and a variable speed pulley clutch are illustrated in a 4page pamphlet. Cizek Mfg. & Distributing Co., Clutier, Iowa.

Circle number 317 on reader service card

INSTRUMENT GEAR CATALOG

... grades gears, racks, and pinions by quality, material, and price. Pitch ranges from 20 to 120 are available from stock. Armac Gears, Chicago,

Circle number 318 on reader service card

IDLERS . . . for all basic types of belt conveyors are described and illustrated in 48-page Bulletin 171. Includes dimensions, engineering tables and selection procedure. Hewitt-Robins, Inc., Stamford, Conn.

Circle number 319 on reader service card

DESIGN SHOW PREVIEW

continued from page 44

Miniature transmission

Case dimensions of transmission are 41/4 in. wide, 71/2 in. long, and 35/8 in. high. There are 15 exact speeds from 3.3 to 7812 rpm electronically controlled by magnetic clutches. More than half the gears are made of Dupont Delrin. Input motor is reversible and self governed at 8500 rpm. Torque in either direction is over 100 oz.-in. according to speed. At 7812 rpm transmission develops over 1/3 hp. Units operate at 115 v. 60 cycles.

Dynamic Gear Co. Inc., Long Island, N. Y., Booth 1104.

Circle number 218 on reader service card

Magnetic disc clutch

Magnetic flux does not pass through the disc stack in this clutch. This allows use of friction materials suitable to the application. Discs remain free of residual magnetism so that little idle torque is developed and heat from running a disengaged clutch at high speeds is reduced. A bolt-on design cuts out the need for flange and spline drives. Clutch is suitable for remote control and for uses where precise control at high frequency with quick response is needed.

Eclipse Machine Div., Bendix Aviation Corp., Elmira, N. Y., Booth 934. Circle number 219 on reader service card

Magnetic brake

A line of 13 sizes is available with non-magnetic flanges which have inside and outside pilot registers and mounting holes. Brakes are adaptable to through shaft mounting and oil or dry operation.

Fawick Airflex Div., Fawick Corp., Cleveland, Ohio, Booths 1136, 1138. Circle number 220 on reader service card

Geared motor

An instant-reversing motor applies full power in either direction by



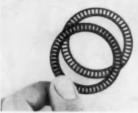
switch actuations. Ratings are 1/6 through 1 hp, with torque multiplied by gearing up to 30 times. Unit has built-in adjustable limit switches. A safety feature, also built-in, reverses the motor at a predetermined resistance force. Includes connections for remote control by radio, key switch, or manual switch.

Franklin Electric Co., Inc., Bluffton. Ind., Booths 1705, 1707.

Circle number 221 on reader service card

Nylon bearing cages

Glass-filled nylon is used to make cages for either roller or ball thrust bearings in a wide variety of sizes.



Chief advantage is that loose metal particles imbed themselves in the plastic, reducing bearing abrasion and wear on metal surfaces. If the bearing cage should fail, no metal particles are entrained.

The Garlock Packing Co., Palmyra, N. Y., Booth 2206.

Circle number 222 on reader service card

Motor load indicators

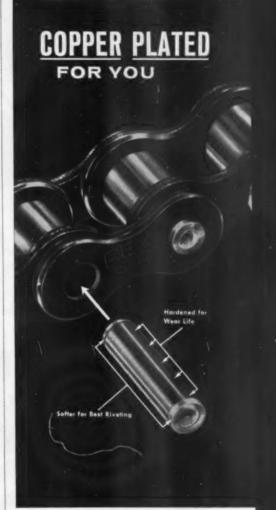
AC models are supplied either as ammeters which measure percent of motor load current, or as wattmeters measuring percent of hp. DC model is an ammeter measuring dc motor input current. AC indicators are for single and three phase, 50 or 60 cycle motors. Scales are calibrated from zero to 150 percent. A single ac instrument can be used with different sized motors by employing a window-type current transformer.

General Electric Co., Schenectady, N. Y., Booths 1724, 1726, 1728, 1730.

Circle number 223 on reader service card

Variable speed control

This cam-operated speed control produces equal speed changes for equal increments of control adjustment. It is said to give linearity of control, and high accuracy setting and holding of speed from maximum Another PLUS value...

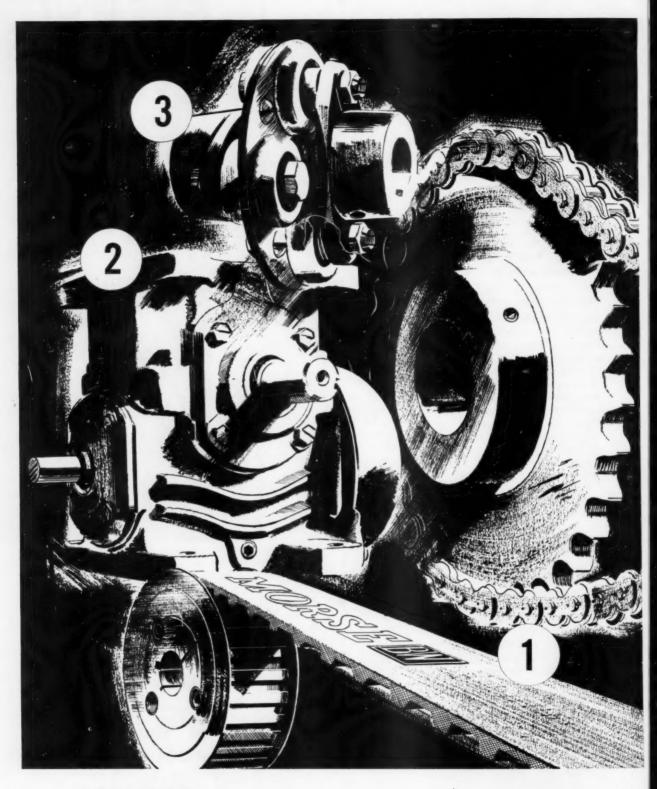


The famous Rex Copper-Plated Pins are one of the important PLUS VALUES you get in Rex Roller Chains.

The softer copper-plated pin ends assure maximum holding power in the link plates and, at the same time, permit the chain to be uncounted easily. The bushing is not displaced when the pin is removed ... no loss of chain life. Hardened pin body provides long wear life. For the story, mail the coupon.



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Eberhardt-Denver "RW" PoweRgear® Reducers, Gearmotors, Worm Gear Reducers, Conveyor Drives, Mitre Boxes, Helical Reducers.

3 COUPLINGS

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Drives, speed reducers, couplings and clutches . . . designed better, built better, distributed better and backed by the only company that takes on the whole job of satisfying you

If you have a production process that requires transmission of mechanical power, it just makes good sense to deal with a company that can take on the *whole* job—furnish all the components—guarantee your satisfaction with the *complete* power train.

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Morse—the No. 1 supplier of automotive timing chains—has, through

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4 CLUTCHES

Morse Cam (Over-Running, Back Stopping, Indexing), Pullmore, Over-Center, Torque Limiter and Centrifugal Styles afford flexible control of power.

MAY, 1960

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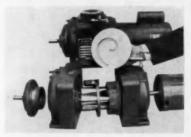
BROOK MOTOR CORPORATION
3302 W. PETERSON AVE., CHICAGO 45, ILL.

In Canada: Brook Electric Motors of Canada, Ltd.
250 University Ave., Toronto, Ontario



DESIGN SHOW PREVIEW continued

to zero. A roller carrier fixed to the motor shaft supports 3 tapered rollers which are engaged by an encircling traction ring. Pinions fixed to the



large end of the rollers engage a ring gear joined to the output shaft. To change speed, the traction ring is moved lengthwise, engaging the rollers at varying diameters.

Graham Transmissions Inc., Menomonee, Wis., Booth 835.

Circle number 224 on reader service card

Rod seal

Consists of a D-ring and double wedge-shaped back-up rings to prevent extrusion. Pressure produces a double-cam action in the wedges

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It's Waterproof. The Perfect Lubricant for all chain sizes. Assures long, trouble-free performance—lower maintenance costs. Combats rust and moisture.

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POWER TRANSMISSION DESIGN

which extends them fully against the rod and gland OD and closes the rod clearance.

Greene, Tweed & Co., North Wales, Pa., Booth 336.

Circle number 225 on reader service card

Zinc alloy gears, pinions

One-piece gear and pinion combinations are die cast from stock dies.



Gears and pinions are to AGMA standards for fine tooth 14·1/2° involute form gears with slight modifications. Special gear and pinion combinations are made to customer specifications.

Gries Reproducer Corp., New Rochelle, N. Y., Booth 2435.

Circle number 226 on reader service card

Nylon snap bushings

Bushings in sizes for mounting hole diameters of 3% to 134 in. They can be locked in position by finger pressure and provide insulation and mechanical protection for cables, wire harnesses, or cord sets from raw edges or chassis holes.

Heyman Mfg. Co., Kenilworth, N. J., Booth 1217.

Circle number 227 on reader service card

Clutches, couplings

Three lines of clutches and a line of centrifugal couplings are shown. Over-running clutches are for automatic two speed, dual drive, or infinitely adjustable ratchet operation. Single revolution and slip clutches are also a vailable. Centrifugal clutches provide automatic flexible coupling on all types of equipment.

Hilliard Corp., Elmira, N. Y., Booth 1905.

Circle number 228 on reader service card

Synthetic packing

A compound of phenolic resin and Buna N known as Rex-Syn. It is said to have low friction properties, high

HOW TO SELECT FLEXIBLE SHAFTING FOR POWER DRIVE APPLICATIONS



11/4-inch STOW Power Drive flexible shaft with core assembly pulled out of casing.

For Power Drive applications, the following factors must be considered:

1. Torque (Lb. Ir.) to be transmitted (The starting torque should be used in making selections.)

2. Operating Speeds (RPM) — If the maximum speed is higher than the rated speed, torque ratings in the table below do not apply. To find the torque capacity for flexible shafts operating at speeds higher than the rated speeds, multiply the maximum dynamic torque capacity by the rated speed, and then divide by the operating speed. (See example.)

3. Operating Radius — In making the selection from the table below, the radius of the smallest bend in the flexible shaft should be used.

Ratings — The ratings for flexible shafts shown in the table below apply under the following conditions:

I. When the flexible shaft is adequately supported by clamps along its length. (For unsupported shafts, multiply the calculated torque by a safety factor of 1.6—see example below.)

empie below.]

2. When the flexible shaft is operated in the wind-up direction, which tends to tighten the outer layer of wires. (Flexible shafts operated in the unwind direction will transmit only about 60% of the rated torque.]

forque.)

3. When the flexible shaft is in continuous operation. Note: the ratings are based on temperature rise. When the operation is intermittent, the ratings in the table may be exceeded. Consult Stow engineers for specific recommendations.

RATED SPEED		MAXIMUM DYNAMIC TORQUE CAPACITY (LB. IN.)											1 -
				STRAIL	GHT AN		Core Dia.	Core No.	if Size				
				RADIUS	OF CU	Wgt./ C. ft.							
R.P.M.	50 to Strgt.	25	20	15	12	10		6	5	C. 11.	510.	una type	45
4,500	2.4	2.2	2.0	2.0	1.92	1.9	1.7	1.5	1.25	3.0	.124/.128	2049 MH	13
3,800	70	6.4	6.0	5.8	5.4	5.0	4.6	3.6	2.0	4.5	148/.152	2081 MH	1.5
2,900	9.4	8.6	8.0	7.6	7.0	6.6	6.0	4.8	3.4	7.0	.185/ 189	5108 MH	19
2,500	22.0	20.0	18.8	17.6	16.0	15.0	12.6	10.8	9.0	12.5	247/.252	8924 MH	25
1,800	30.0	28.0	26.4	25.0	23.0	21.0	180	14.0		20.0	.308/.313	8925 MH	31
1,800	33.8	31.5	29.7	28.1	25.9	23.6	20.2	15.8		20.0	.308/.313	8969 T	31
1,800	36.0	33.0	31.6	30.0	28.0	26.0	22.0	18.0	11.0	21.0	324/.329	2034 A	31
1,500	80.0	66.0	63.0	58.0	51.0	46.0	37.0	22.0		28.5	.368/.374	2035 A	38
1,500	60.0	54.0	50.0	46.0	42.0	38.0	30.0	24.0		29.0	.387/.393	8970 MH	40
1,500	90.0	81.0	75.0	69.0	63.0	57.0	45.0	36.0		29.0	.387/.393	8971 T	40
1,150	136.0	110.0	104.0	94.0	80.0	72.0	56.0			50.5	.497/.503	8999 A	50
1,150	148	124	110	92	72	56				53.5	.505/.511	6940 T	50
900	248	200	176	124	84			-		78.5	.610/.618	6997 T	63
900	220	204	192	180	152	130				80.5	.630/.638	7731 A	63
750	340	224	156	76						117	747/.753	2056 T	75
600	760	520	420							205	.998/1.004	2057 T	100
440	1,500	720								343	1.298/1.304	2058 T	125

EXAMPLE: How to use the table: The problem is to transmit ½ HP at 170. RPM through an unsupported flexible shaft in a 25" radius, estimated starting torque 150% of normal operating torque.

1. Calc. Torque HP x 63000 RPM = .5 x 63000 1700 = 18.5

2. Correction factor for starting torque $1.5 \times 18.5 = 27.75$

- 3. Correction factor for unsupported shaft 27.75 x 1.6 = 44.4 lb. in.
- 4. Refer to Table above. Read downward in column under 25" radius until you find a core having a rating of at least 44.4 b. in: In this case we find that core No. 8770 is rated 54 lb. in. at 1500 RPM. Since the given speed is 1700 RPM, multiply 24 by 1500 and divide by 1700. 54 x 1500 + 1700 = 47.5 lb. in. (rated torque at 1700 RPM). Therefore, Core No. 8770 is correct.

For Engineering Bulletin No. 570 and a free torque calculator, write



STOW MANUFACTURING COMPANY

440 Shear Street Binghamton, New York

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DESIGN SHOW PREVIEW continued

tensile strength and resistance to abrasion and to chemical attack over the entire pH range.

E. F. Houghton & Co., Philadelphia, Pa., Booths 1207, 1209.

Circle number 229 on reader service card

Missile encoder bearing

A 10 in. OD flanged bearing is made to .0001 in. tilt measured approximately 3 in. from the center of the bore and has less than 10 in.-oz of torque.

Bearing Div., Industrial Tectonics, Inc., Compton, Calif., Booth 1404.

Circle number 230 on reader service card

Speed reducer

Reducer is NEMA "C" face type for motor ratings from ½ to 5 hp and gear ratios from 4:1 to 90:1. Features are hardened steel worm, phosphor-bronze gear and high tensile steel shaft. High speed shaft has ball bearings.

Janette Electric Mfg. Co., Morton Grove, Ill., Booth 626.

Circle number 231 on reader service card

Rocker arm

This rocker arm is stamped in its finished form from a single piece of steel. It is said to have the advan-



tages of greater rigidity, more design versatility, and lower production costs.

Laminated Shim Co., Glenbrook, Conn., Booth 1221.

Circle number 232 on reader service card

Magnetic powder clutch

Clutch is part of the Leartron 60 remote control system. It contains a metallic powder in the air gap between the continuously-rotating body of the clutch and the low inertia disc. When energized, the magnetic particles span the gap and couple the

body and the shaft. The shear strength of this magnetized mass of particles is proportional to the excitation current. Torque output is linear with excitation current. These clutches are said to have exceeded fifty million cycles of operation without deterioration.

Lear, Inc., Grand Rapids, Mich., Booth 339.

Circle number 233 on reader service card

Oilless bearings

Bearings, bushings, and piston rings are available in hardwood. Chief



advantage is that it is self-lubricating in conditions where normal lubrication is impossible,

Lignum Vitae Products Corp., Jersey City, N. J., Booth 2417.

Circle number 234 on reader service card



Small Units for Big Jobs! EATON DYNA-TORQ

MAGNETIC-FRICTION
CLUTCHES and BRAKES

Now Available in a Full Line from 13/4" to 15" Diameter

Eaton Dyna-torQ Magnetic-Friction Clutches and Brakes provide a simple, accurate, responsive method of controlling power and motion in today's complex production and processing machines.

The smaller sizes and advanced design types of Dyna-torQ Stationary-Field Clutches and Brakes enable Eaton to offer a well rounded line, including flange-mounted and bearing-mounted clutches, and replaceable-face brakes. Unique features of design and construction result in worthwhile maintenance cost savings. Dyna-torQ units, easily and quickly installed on new machines or existing plant equipment, deliver many highly desirable advantages.



STATIONARY-FIELD, BEARING-MOUNTED DYNA-TORQ CLUTCH

Dyna-torQ Magnetic-Friction Equipment Offers these Important Advantages:

- * Accurate power control
- ★ Dependable motion control
- * Rapid response
- ★ Easy "built-in" installation
- ★ Low maintenance costs
- ★ Compact plug-in type controls—may be remotely mounted
- ★ Inter-changeability of parts

Send for this illustrated bulletin giving complete description and specifications covering DynatorQ Stationary-Field Clutches and Replaceable-Face Brakes.





Dyna-torQ Equipment is Available through Dynamatic Distributors in all Leading Cities

EATON

MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

MAY, 1960

67

ACCURATE DEPENDABLE ECONOMICAL

Timeworn adjectives, to be sure — However, they tell the story of

GLOBE STOCK GEARS



A complete line of industry standard gears from 3 To 24 Pitch

Available Through Leading Power Transmission Distributors

GLOBE STOCK GEAR DIVISION

34th and Clearfield Streets Philadelphia 32, Pa.

Circle No. 61 on Reader Service Card

DESIGN SHOW PREVIEW continued

Flexible couplings

Type MC geared flexible coupling is improved by a cover of polypropylene which resists chemical attack.

This coupling is available in a 2½ in, bore size with a new type of spacer adapter which can serve as a demountable shaft extension.

Link Belt Co., Chicago, Ill., Booths 2105, 2107.

Circle number 235 on reader service card

Variable speed pulleys

A series of pulleys comes in six sizes from fractional to 5 hp and



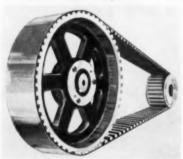
with speed ratios up to 4:1. Pulleys can be quickly installed on old or new equipment.

Lovejoy Flexible Coupling Co., Chicago, Ill., Booth 1504.

Circle number 236 on reader service card

Belt drive

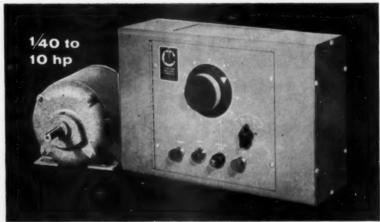
Belt teeth mesh into pulley grooves. High initial belt tension is not needed, which means minimum bearing load and low heat build-up. There's no



metal contact, so no need for lubrication. Other advantages claimed are: no rise and fall of pitch line, no slipping, creeping, or backlash.

Maurey Mfg. Corp., Chicago, Ill., Booth 2317.

Circle number 237 on reader service card



Electrical Adjustable Speed Drives



If you are looking for a compact, low-cost electrical drive and your application does not demand the precise speed regulation of an electronic unit, you may find exactly what you need in the CMC line of Electrical Adjustable Speed Drives . . . These skillfully engineered drives require only four wires to the dc motor and two for ac power . . . Complete with dripproof 1750 rpm dc motors. Gearhead, totally enclosed and other motor types available.

COMPACT CONTROL UNIT . MODULAR CONSTRUCTION . INFINITELY VARIABLE REVERSING AND DYNAMIC BRAKING STANDARD . IMMEDIATE DELIVERY

We also offer a complete line of full-wave electronic drives featuring fine speed regulation, wide range of adjustment and unique construction.

CLEVELAND MACHINE CONTROLS, INC.
1155 BROOKPARK ROAD CLEVELAND 9, OHIO

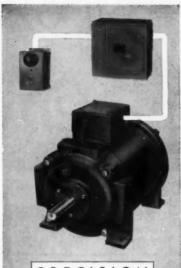
Circle No. 71 on Reader Service Card

POWER TRANSMISSION DESIGN

SELECTION Design Engineers' Handbook" which help you specify the right chain for Write today for your copy. The control of the control

Here is a quick, easy reference chart for comparing the seven most popular Moline Chains. Are you familiar with all the attachments available...the range of sizes...and all their applications? This chart will help you compare their size, capacity range and various uses. It's a part of the new, illustrated "Moline Conveyor Chain Manual and Design Engineers' Handbook" which is available now to help you specify the right chain for your requirements. Write today for your copy.

	CHAIN TYPE	APPLICATION AND INSTALLATION	ATTACHMENTS	PITCH EANGE IN INCHES	ULTIMATE STRENGTH IN USS.
4	Detachable Chains—25, 32, 33, 34, 42, 45, 50, 51, 5-51, 52, 55, 57, 62, 67, 75, 77, 78, 88, 95, 103, 108, 114, 124	Widely used throughout industry, conform to "manufacturers' standard" and available in a wide variety of sizes. Many attachments make this type versatile and adaptable to any light to medium-duty conveyor service.	A-1-2-3-12-110 C-1-5-8-15 D-3-4-5 E-1 F-2-8-16 K-1-2-3-5-40-73-345 H-1-2 K-1-2-3-5-40 L-2 M-1-3 R-1-2 S-1 Scraper 1-29	.902 to 4.063	700 to 17,000
0000	Pintle Chains 400 class. Light weight Pintle. 700 class.	Serviceable, long-wearing, moderately- priced chain for general elevating, conveying and power transmission service for drives at low and intermediate speeds with moderate loads. In "400" lightweight and "700" class types.	A-1-12-115 D-5 E-1 F-2-5-16 G-1-6-19 K-1-2 M-1 F-2-5 F-22-6" F-2-22-8" A-2-42 K-1-2-720-A-2-730 720-M-1 M-1-2	1.375 to 4.720	4,200 to 22,000
2 3 3 3	H-Type Mill H-60, H-62, H-74, H-75, H-78, H-82, H-85, H-87, H-95, H-124	Designed primarily for heavy drives and transfer conveyors in saw mills and pulp and paper mills but widely used throughout industry. Strong and rugged, provided with wearing shoes for stiffness and long service life.	A-1-12 F-4 G-1-6-19-48 H-1-2 K-1-2 M-3 R&L RR	1.654 to 4.000	7,000 to 30,000
	Combination Type Mill Chain 6104, 6110, 8116, 8480	Designed for the same applications as regular H-type conveyor chains and refuse chains but has larger diameter rivet, greater ultimate strength for more rugged duty in general drag conveyor service applications.		6.00 to 8.00	42,000 to 56,000
	Combination Chains—C-55, C-77, C-102B, C-102½, C-110, C-110-C, C-111, C-111-C, C-131, C-131-C, C-132, C-132-C, PW-132, C-188, MW-188	Very rugged and serviceable for use in bucket, transfer and many other types of conveyors. Widely used in cement, chemical, lumber, quarrying, mining industries. Available in pin and cotter assembly or riveted construction.	C-3-132 RF-12 F-2 G-6-19 K-1-2-3 LL-25	1.631 to 6.050	9,000 to 50,000
	Doiry Conveyor MC-33	Extensively used in dairy and bottling industries, designed for both horizontal and lateral turning. Detachable construction, interchangeable with manufacturers' standard 4250, available only in extra strength Promal.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2.500 only	12,000
	Ley bushed Chain—823, 825, 830, 844	Developed for hard, rugged service under extremely abrasive and other adverse conditions. Used extensively in conveying or elevating sand, gravel, cement and in similar industries where service demands are rigid.	K-2 F-2	4.00 to 6.00	19,000 to 40,000
Write today for your free copy of the Moline Conveyor Chain Manual and Design Engineers' Handbook.	MOLINE Conveyor Chain Manual	Ivioline Moline Malleable Iron Specializing in the manufacture of	for help on y plete design cial chains Cha co., St. Char		olem Com- ale for spe- oplications.



PRECISION

ELECTRONIC

ADJUSTABLE-SPEED DRIVES

- O SPEED RANGE Infinitely adjustable from less than 36 rpm to more than 3600 rpm while delivering full rated torque. Continuous duty rating at all speeds.
- O REGULATION Both line and load regulation is better than 1/2 of 1% of rated speed.
- O HORSEPOWER Various models from ¼ hp down to 1/200 hp. Motors of ¼ hp and larger are totally enclosed.
- REMOTE CONTROL A 10-turn potentiometer provides precise adjustment at any convenient location.
- O GEARED MOTORS Motors are available with integral gear re-
- O BRAKING-REVERSING Relay-controlled braking and reversing models available.
- MAINTENANCE Fully encapsulated construction results in long service life. Plug-in construction requires only a screwdriver for servicing.
- O OTHER MODELS Servo-Tek manufactures drives with silicon rectifiers and adjustable autotransformers, as well as other thyratron drives with less exacting specifications. Write for information including details of your proposed use.

IMMEDIATE DELIVERY



Circle No. 57 on Reader Service Card

DESIGN SHOW PREVIEW continued

Maintained-contact switches

Additions to the LS and 200 LS series of limit switches have yoke actuators that rotate 360 degrees and lock in any position. When moved from one extreme position to the other, the actuator works the internal switching unit, to transfer and maintain circuit. Actuator heads can be mounted in four positions, 90 degrees apart. Plungers and head assemblies are sealed by O-rings, switch enclosures by neoprene rings so that switches are oiltight.

Micro Switch, Freeport, Ill., Booth 1202, 1203.

Circle number 238 on reader service card

Structural adhesive

Thermosetting film adhesives are said to provide uniform adhesive thickness throughout the joint, controlled confinement of the adhesive to the bonding area, and simple application procedures. Uses include bonding tubes, gear and shaft assemblies, rotor blades, etc.

Minnesota Mining & Mfg. Co., St. Paul, Minn., Booths 1718, 1720.

Circle number 239 on reader service card

Gearmotor

Direct coupling of motor and reducer eliminates misalignment and



saves space. Reducer is "C" flange type built to NEMA standards.

Morse Chain Co., Ithaca, N. Y., Booth 1931.

Circle number 240 on reader service card

Cage-type roller bearings

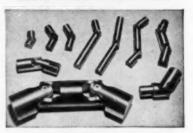
Two new series of bearings for ap-

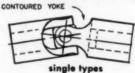


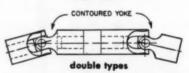
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INDUSTRY'S MOST COM-PLETE LINE FOR EVERY SLOW SPEED APPLICATION







Check these features against your requirements:

Special Contoured Yoke—capable of operating at a maximum angular misalignment of 45° on hand-operated applications.

Static Torque—from 306 to 129,693 in.-lbs. at 12°, depending on size of joint.

Horsepower Ratings—.54 to 207 at 100 rpm.

Tolerances—pins ground to .0005' ... forks concentric to within .001' ... precision accurate center blocks.

Standard Specifications—hub diameters ½ to 4"...bores ¼ to 2"...lengths (single) 2 to 10%," (double) 4 to 21¼". All specifications can be altered or special joints designed to individual requirements.

Get this handy guide

It's the quick and easy way to get the Universal Joint that is just right for your application. Request Bulletin 820.



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Circle No. 27 on Reader Service Card
POWER TRANSMISSION DESIGN

Franklin INST-O-VERSE Motors ENCOURAGE PRODUCT DESIGN IMPROVEMENT



■ Standard INST-O-VERSE® Motors

Full-torque, instant-reversing motors available in 1-phase, 1725 RPM, 115 or 230 V., 1/6 H.P. through 1 H.P., sleeve or ball bearing types with NEMA standard or application-engineered mountings. Cost is less than 3-phase reversing motors.



■ Instant-reversing GEARMOTOR power units

Built to specifications with epicyclic, worm, bevel or other gears. Ratios to requirements. Automatic or manual controlled . . . on-off, forward-reverse operation of one or more output shafts.



■ GEAR-O-MATIC® power package for automation

Includes all functional benefits of any signal transducing system to energize stop-go, and instant-reversing of geared power unit. Limit switches, automatic safety stop and indicator outlet are built into control box.



■ Special MULTI-SHAFT system

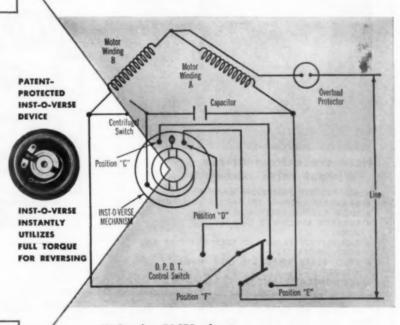
Franklineered to customer requirements, push-button controls monitor selective actions of 3 output shafts. Designed for dependable performance and long life for applications requiring high reliability.

Control switch in "E" position . . . rotation is clockwise. Inst-O-Verse makes contact in "D" position due to shaft rotation. Motor operates as capacitor start, induction run with "B" as start winding.

Instant reversal occurs when control switch is thrown to "F" position as the Inst-O-Verse device has provided a circuit, bypassing the open centrifugal switch.

Operates in either direction as capacitor-start motor or instantly reversing motor. Operation is independent of sequence of rotational operation.





Write for FACTS about:

- INST-O-VERSE MOTOR
 - OR GEAR-O-MATIC MOTORS
 MULTI-SHAFT SYSTEM

Franklin Electric Co., Inc. BLUFFTON, INDIANA

Circle No. 60 an Reader Service Card



Precision Machined Solid Steel

CONVEYOR PULLEYS



A fully machined pulley at prices equal or lower than light duty rolled sheet metal pulleys. Available in diameters from 4 in. to 48 in. Face

widths up to 144 in.
All pulleys balanced and machined



Here are extra features— Without extra cost—

- . ALL PULLEYS PRECISION MACHINED
- . SEAMLESS SURFACE ON FACE OF ALL PULLEYS
- . HIGH CROWN FULLY MACHINED
- . SURFACE MACHINED CONCENTRIC WITH
- COMPLETELY SEALED TO KEEP OUT DIRT AND FOREIGN MATTER
- STEEL PLATE DISCS ARE CONTINUOUSLY WELDED
- . ECONOMICALLY PRICED

LAGGING SPECIAL

New Tiger Grip lagging applied at the low cost of only 30% of the value of the pulley.

Literature and prices on request.
Territories available for distributors.

ROCKWOOD PULLEY MFG. CO.

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Circle No. 56 on Reader Service Card



T-Liner bearings consist of an outer shell of metal with a thin liner of Rulon:

- · require no lubrication
- · high resistance to wear
- wide temperature range (-300°F to +525°F)
- · low co-efficient of friction
- · unexcelled chemical resistance
- self compensating to pressure and temperature

*Dupont's TFE

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Artus Plastic Shims are real time savers in production and maintenance. They're used by many of America's best known industrial corporations because they're more efficient, more convenient, always available.

Custom shapes to your specifications.

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POWER TRANSMISSION DESIGN

DESIGN SHOW PREVIEW continued

plications needing maximum radial capacity have relieved end rollers to reduce stress and fatigue at corners. Rollers are square end type retained in pockets of the tubular steel cages. The MC series is interchangeable with standard needle bearings, but uses larger diameter and length of rollers for greater load capacity. The HS series, for applications where radial space is available, is heavier sectioned.

Orange Roller Bearing Co., Inc., Orange, N. J., Booth 1636.

Circle number 241 on reader service card

Angularly adjustable coupling

A line of adjustable couplings gives precision rotational angular adjustment between two synchro motors or other mechanisms needing angular displacement. By rotating one



synchro rotor through the coupling, it can be zeroed in with its companion synchro without rotating it in its mounting.

PIC Design Corp., East Rockway, N. Y., Booth 1208.

Circle number 242 on reader service card

Low-cost bearing nylon

Called Polypenco MC Nylon 901, it's said to have better resistance to deformation under load, to wear longer, and have better dimensional stability than standard nylon. Prices on tubular bars have been cut up to 50 percent. Tubular bars are made in OD sizes from 2 to 15 in.

The Polymer Corp., Reading, Pa., Booth 1513.

Circle number 243 on reader service card

Flexible couplings

By stroboscobic markings on the coupling case, sleeve and hub teeth can be lined up to mesh completely while the units are running. Small

SAVE SPACE, WEIGHT, COST WITH NEW, COMPACT



Pictured Drives Compared:

For 30 HP with 1.4 Service Factor—Savings Vary with Other Drives

	Sheaves					Belts		Center	Weight		Cost	
	00	river	OD	Driven	Face	Number	Size	Distance		HP	Per HP	Per Drive
QD V-Belt Drive	8	.4"	1	6.4"	53/8"	5	C75	19.7"	108.5	44.3	\$2.81	\$124.45
QD Hi-Cap Drive	7	.1"	1	4.0"	31/4"	4	5V710	18.6"	90.2	47.0	\$2.33	\$109.96
Hi-Cap Saves	15	.5%	1	4.6%	43%	20%		5.6%	16.9%	+6.1%	17.1%	11.6%

After more than two years of toughest use-testing, Fort Worth introduces the Hi-Cap Wedge Drive. Supplementing conventional V-belt drives, Hi-Cap Wedge is recommended for . . .

- COMPACTNESS Where a more compact drive is desired than possible with conventional V-drive equipment.
- SAVINGS In installations above 10 horsepower, Hi-Cap Wedge compares in cost favorably to the conventional V-drive; above 25 horsepower, Hi-Cap will provide cost savings over most other drives.
- NEW APPLICATIONS Extending the V-drive application range, Hi-Cap
 Wedge offers advantages for many installations where other types of
 belt drives or chain drives have been common.
- RATIOS AVAILABLE Hi-Cap Wedge stock sizes provide selection of sheave and belt sizes to assure systematic coverage of speed ratios in evenly spaced increments.

All Hi-Cap Wedge sheaves are new designs, using the same QD bushings as conventional QD sheaves and QD roller-chain sprockets.

Compactness of Hi-Cap Wedge drives is made possible by removal of "fat" from belts but without sacrifice of sidewall contact with sheave grooves. This and super-strong Green
Seal cords give belts greater power-transmission capacity with less bulk.

For the name of your nearest FORT WORTH Distributor, write to . . .



FORT WORTH 1, TEXAS

V-BELT DRIVES-ROLLER-CHAIN DRIVES-SCREW CONVEYORS-INDUSTRIAL FANS

Warchouse Stocks in Fort Worth, Jersey City, Memphis, Atlanta, Chicago, St. Louis, Kansas City, Houston, Oklahoma City, Denver, Los Angeles, San Francisco; Sales Office in High Point, N. C.

Distributors Inquire about Franchises, Select Areas Available Now
Circle No. 64 on Reader Service Card

DESIGN SHOW PREVIEW continued

variable speed reducers balance the rotation of the coupling with the frequency of the light. The use of curved teeth is another feature, permitting misalignment up to plus or minus 5 deg.

Poole Foundry & Machine Co., Baltimore, Md., Booth 428.

Circle number 244 on reader service card

Strap type pillow blocks

For shaft sizes 1 3/16 to 2 3/16 in. Blocks have steel housings and self-lubricating self-aligning ball assemblies. Designed for compactness and to cut down replacement costs,



units feature a simple two-bolt mounting arrangement which automatically draws the cap into proper adjustment against the base.

Randall Graphite Bearings, Inc., Lima, Ohio, Booth 914.

Circle number 245 on reader service card

Ribbed belt drive

Known as the Poly-V Drive, it's a flat belt with a ribbed traction surface which runs in sheaves grooved to mate with the ribs of the belt. Belt is single, endless, with a synthetic cord member across its entire width. Increased hp with narrower sheaves and half the face pressure results from increased contact area. Pitch and speed ratios are constant under all loads.

Raybestos-Manhattan, Inc., Passiac, N. J., Booths 1810, 1812.

Circle number 246 on reader service card

Ball bearing splines

Produced in six sizes, ball bearing splines range from 3/8 in. to 3 in. in diameter. They operate with little friction, and are said to be suited for applications requiring low resistance to linear motion, long trouble-free service life, and minimum radial lash. Design has a gothic arch race configuration, giving uniformity and allows, when necessary, pre-loading of inner to outer member. The splines can be fitted with integral gears or sprockets, clutching devices, trunnions, flanges, and bearings.

Saginaw Steering Gear Div., Saginaw, Mich., Booth 1508,

Circle number 247 on reader service card

Flexible gear couplings

A coupling with a nylon sleeve weighs only $3\frac{1}{2}$ lb., needs no lubrication, and is said to take substantial misalignment. Ten bore sizes are available from 7/16 to $1\frac{5}{8}$ in. Standard designs have speeds up to 5000 rpm with torque at 530 lb.-in. Hobbing of the steel hubs stops gouging of the nylon sleeve. Unit will take both angular and parallel misalignment and end float with minimum backlash.

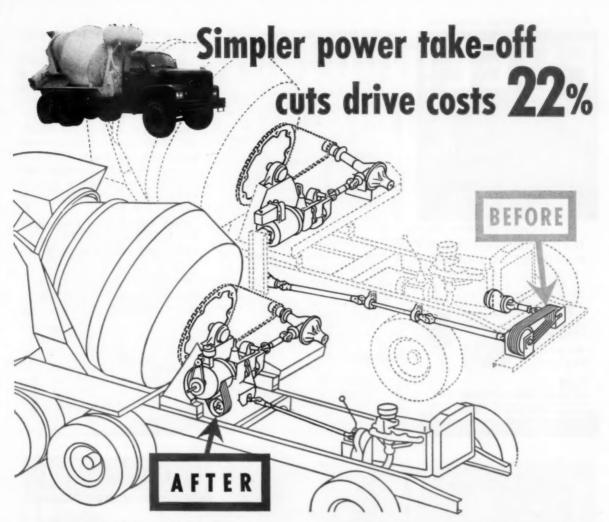
Sier-Bath Gear & Pump Co., Inc., North Bergen, N. J., Booth 2031.

Circle number 248 on reader service card





CITCIE No. 22 on Reader Service Card
POWER TRANSMISSION DESIGN



Super HC V-Belts-packing higher hp capacity in smaller space than conventional V-beltshave eliminated need for front-end power take-off on concrete-mixer trucks made by Concrete Transport Mixer Company of St. Louis, Mo.

By letting take-off be shifted to rear, Super HC V-Belts cut drive costs alone by 22%, besides saving weight and cost of complex linkage and other components of the former front-end drive.

With Super HC, sheave diameters can be cut 30% to 50%, drive space up to 50%, and drive weight 20% and more. A product of Specialized Research in the world's largest V-belt laboratories. Super HC V-Belts are helping many manufacturers put more compact, lighter weight, lower cost drives on all types of machines.

Engineering Service Nation-Wide

What's your power transmission design problem? Your Gates Field Representative is ready to help you solve it— to cut space, weight, cost with Super HC V-Belt Drives. Ask

him for your free copy of "The Modern Way to Design Multiple V-Belt Drives" or write The Gates Rubber Company Sales Division, Inc., Denver, Colorado.

The Gates Rubber Company, Denver, Colorado Gates Rubber of Canada Ltd., Brantford, Ontario



World's Largest Maker of V-Belts



Gates Super (HC) V-Belt Drives same hp capacity in smaller "package"



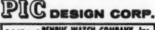


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GEARS • SHAFTS • COLLARS • CLUTCHES • BEARINGS • COUPLINGS • DIFFERENTIALS • SPEED REDUCERS and many other Precision Engineered Parts & Components,

Send For Your Copy Today.



Subsidiary of BENRUS WATCH COMPANY, Inc.
477 Atlantic Ave., East Rockgway L.I. N.Y.

DESIGN SHOW PREVIEW continued

Electric clutches/brakes

Additions to a line of electric clutches and brakes are a fixed field duplex clutch (FFD-40) and a



through shaft fixed field clutch-brake combination in the size 40 series of of 1-9/16 in. diameter. The new design eliminates slip rings and brushes.

Simplatrol Products Corp. Worcester, Mass., Booth 2415.

Circle number 249 on reader service card

Bearings

A complete line of ball and roller bearings includes single and double row deep groove ball bearings, selfaligning ball bearings, spherical roler bearings, cylindrical roller bearings, and double row Tyson tapered roller bearings.

SKF Industries Inc., Philadelphia, Pa., Booth 1932.

Circle number 250 on reader service card

Reversing transmission

Two speeds forward, neutral, reverse, and speed reduction are combined into a single unit. The Model 5131, it transmits up to 8 hp at an input speed of 2400 rpm. Reduction ratio is 1.97:1 and 3.36:1 in forward speeds and 3.49 in reverse.

Snow-Nabstedt Gear Corp., Hamden, Conn., Booth 1709.

Circle number 251 on reader service card

Tiny collars

Designed to meet miniaturization needs in electronics and instruments,





Now Outdates Wood Block and Variable Speed V-Belts

MVS Belt replaces enclosed drive belts without disassembly. Its patented design sets a new standard in V-to-V drives because it is adjustable and is installed in minutes instead of hours. Uniform thickness and width guarantee constant power delivery with no cross-sectional distortion. Available in 26 widths from $1\frac{1}{2}$ " thru 5".

Write Today For Complete Information



MANHEIM

MANUFACTURING & BELTING COMPANY Manhelm 9, Penna.

Circle No. 28 on Reader Service Card



Circle No. 3 on Reader Service Card
POWER TRANSMISSION DESIGN

a 1/16 in. shaft diameter collar is believed to be the smallest of its kind. The collars are used to take up thrust, for locking, spacing, and positioning shafts and other applications.

Standard Pressed Steel Co., Jenkintown, Pa., Booth 2124.

Circle number 252 on reader service card

Ball bushings

This ball bearing is for sliding linear motions. One type has adjustable



shaft diameter, the other is open, for zero clearances on the supported shaft. Shaft diameters range from 1/4 to 4 in.

Thomson Industries, Inc., Manhasset, N. Y., Booth 2115.

Circle number 253 on reader service card

Shaft mounted reducer

Gears are honed to an exact elliptoidal tooth profile so that they mesh in the strongest central portion. Teeth are through-hardened to 45/50 Rockwell C. Known as the type GC Synchrogear, this reducer has a size range of ½ to 40 hp, in speeds of 5 to 125 rpm. Two ratios are offered—15:1 or 24:1. Case is of cast iron, with the two halves dowelpinned and integrally bored to assure shaft parallelism.

U. S. Electrical Motors, Inc., Los Angeles, Calif., Booths 1704, 1706. Write number 256 on reader service card

Electric motion controls

Three products for improved control of machinery are: spline drive armature for clutches and brakes in heavy duty service: a clutch-pulley package for direct installation on standard NEMA electric motor shafts; and miniature electric clutches and brakes.

Warner Electric Brake & Clutch Co., Beloit, Wis., Booths 1004, 1006, 1010.

Write number 257 on reader service card

Another H&S Speed Reducer on a tough job...

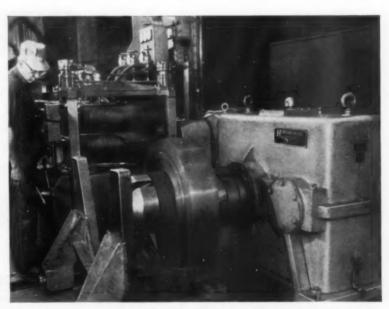
Built rugged for a critical rewind operation, this heavy overhung-load type H & S Herringbone Speed Reducer delivers day-in-day-out service under exacting load conditions.

This standard unit was selected for use on a Bliss precision rewind coiling machine—where strip steel must undergo tension controlled recoiling for subsequent annealing treatment.

Notice the sturdy shaft, with heavy-duty bearings designed to take this heavy overhung load. Observe the rugged housing, made to last.

This built-in toughness typifies H & S construction on helical, herringbone, worm and combination units.

Send for detailed information on our facilities for producing a complete line of gears and speed reducers in a wide range of sizes and ratings.



Heavily loaded pay-off reel being driven by H & S Speed Reducer in plant of The Acme Steel Company, Chicago.





The HORSBURGH & SCOTT CO.

5112 Hamilton Avenue . Cleveland 14, Ohio

Specializing in fest production of quality Speed Reducers and Georing to meet custom requirements.

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DESIGN SHOW PREVIEW continued

Differential reducer

A planetary type reducer fits any standard "C" flange motor. Flexible coupling connects motor to the input shaft. The ratio range is from 1.1:1 to 50,000:1, with .12 to 81.5 hp capacity. Output torque is from 50 in.-lb. to 113,000 in.-lb.

Winsmith, Inc., Springville, N. Y., Booth 528.

Write number 258 on reader service card

Variable speed sheave

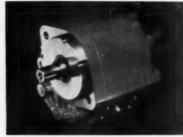
Power is transmitted equally to both flanges through a series of torsionally resilient rubber cam followers between the sleeve caps and flanges. Sidewall pressure on the belt is in proportion to the torque needed for the load. Result is constant driven speeds under varying torque loads. Pumping action of the flange hubs on the sleeves gives an even oil lubrication of the bearing surfaces, cutting out freezing and sticking.

T. B. Wood's Sons Co., Chambersburg, Pa., Booth 1736.

Write number 259 on reader service card

Hydraulic gear pumps

A line of 20 standard pumps has capacities from 0.7 gpm to 140 gpm at 2000 rpm and 2000 psi. There



are five series with four displacement values in each series, available with side or end porting and standard SAE mounting flanges and drive shafts.

Wooster Div., Borg-Warner Corp., Wooster, Ohio, Booth 2213.

Write number 260 on reader service card

Positive drive belts

Molded teeth on the belt engage mating axial grooves on the pulleys. Belts are made of helically-wound steel cables backed with neoprene. Teeth are of nylon-faced neoprene integral with the backing. Five stock pitches are available with matching pulleys.

Worthington Corp., Harrison, N. J., Booths 316, 318.

Write number 261 on reader service card

Variable speed drives

A safety disconnect and automatic reset are features of a new line called the 400 Series. Worm and worm-gear



type control provides precise speed setting and holding. Other improvements are new type gaskets and relocation of oil level, drain and fill plugs, allowing any mounting position.

Zero-Max Co., Minneapolis, Minn., Booth 1640.

Write number 262 on reader service card

WHAT'S
A THOUSANDTH
OF AN INCH...
MORE
OR
LESS?



With couplings operating at high peripheral speeds, it can mean the difference between early failure and long trouble-free life.

That's why all Waldron high speed coupling forgings (of SAE 4140) are first machined to $\pm .001''$, $\pm .000''$, and then hand fitted (sleeves first, then hubs). Bolts and nuts are weigh balanced, and the assembled coupling dynamically balanced as a unit—then match marked for reassembly.

Waldron high speed couplings are now operating at speeds of 70,000 rpm and more, and in drives up to 48,000 HP.

Even if your requirements don't involve such demanding service, it's good to know you have an extra margin of safety and reliability when you specify Waldron High Speed or any Waldron Coupling.



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P. O. Box 791 • New Brunswick, New Jersey

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POWER TRANSMISSION DESIGN

HAVE YOU TAKEN SIDES IN THE BELT DRIVE REVOLUTION?

The change from Multi-V to Multi-Wedge is revolutionizing belt drives. A simple change in shape gives the Wedge Belt greater efficiency. Thus the number of belts can be less, diameters can be reduced 30 to 50% and center distances cut 20% for the same transmitted horsepower. In fact, Multi-Wedge drives result in initial savings up to 20%.

Because of this potential saving, it's to industry's advantage to design Wedge-Belts into new equipment as soon as convenient. But Worthington will supply complete requirements in both Multi-V and Multi-Wedge drives until the latter has completely taken over.

Are you worried about interchangeability of brands? Frankly, five out of the eight leading drive manufacturers now offer Multi-Wedge, as well as the Multi-V drives,

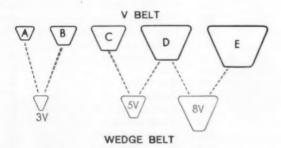
And so far, all Multi-Wedge drives are offered in the same belt and sheave sizes.

There is, however, an important reason for preferring the Worthington Multi-Wedge drive. Worthington makes the QD (Quick Detachable) sheave—the industry's largest seller—in the complete range of Multi-Wedge standardized dimensions. This sheave, with its two Golden Screws, appeals to plant operators because of its positive locking arrangement—easy on . . . easy off . . . always tight.

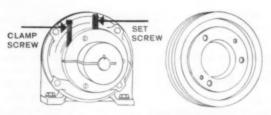
For Multi-Wedge drives, Worthington maintains a large stock of its QD sheaves and Worthington-Goodyear Wedge belts from coast to coast. For information call your Worthington distributor listed in the yellow pages of your phone book. Or write Worthington Corporation, Section 79-28, Oil City, Pennsylvania.



The cord layer near the top of either belt carries the load. This layer is, however, only efficient in the portion supported by side walls (red areas). Because more of its top section is over the side walls, the Wedge belt is more efficient than a V belt.



Because the smaller Wedge belt does more work, the number of sizes have been reduced without loss of flexibility. The new Wedge belts are available in three standard sections: 3V, 5V and 8V. Stock 3V and 5V sheaves cover horsepower ranges through 200 hp. Made to order 8V sheaves will be used for 200 to 2,000 hp. requirements.



Worthington QD sheaves are preferable for Multi-Wedge drives. The clamp screw simplifies installation, assures permanent alignment, and makes it possible to use a set screw without causing hub distortion that might cause eccentric runout. The set screw prevents "key drift" by locking the key securely in place. You install QD sheaves easily—one part at a time. If change in speed is required, you simply install another sheave on the hub which remains anchored to the shaft.



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...if your problem involves applying or connecting power to driven equipment...

...it pays to consult a company that specializes exclusively in correctly linking horsepower to driven equipment. Since 1918, Twin Disc specialists have designed and built Friction and Fluid Drives for just that purpose. Because of this specialization, Twin Disc can make unbiased recommendations regarding the proper type drive—friction or fluid—for almost any type heavy-duty industrial equipment—used in any type application.



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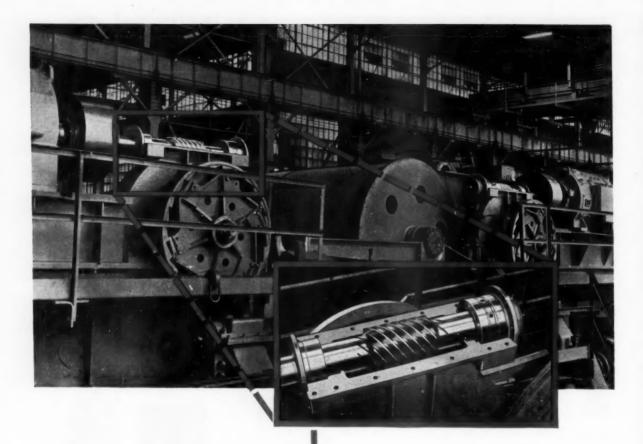
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ORANGE Cage Type NEEDLE BEARINGS

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